THE SKIRMISH WITH THE COSSACKS

Jean Baptiste Edouard Detaille was a well-known French painter of battle scenes. He was the favorite pupil of Meissonier, and, like his master, paints his pictures with regard to the smallest detail. In this picture we see a squad of lawless-looking Cossacks tearing down a muddy roadway, with Napoleon's Imperial Guard in full pursuit. The long spears of the Cossacks are of little use in a conflict like this.

The Book of Knowledge

The Children's Encyclopædia

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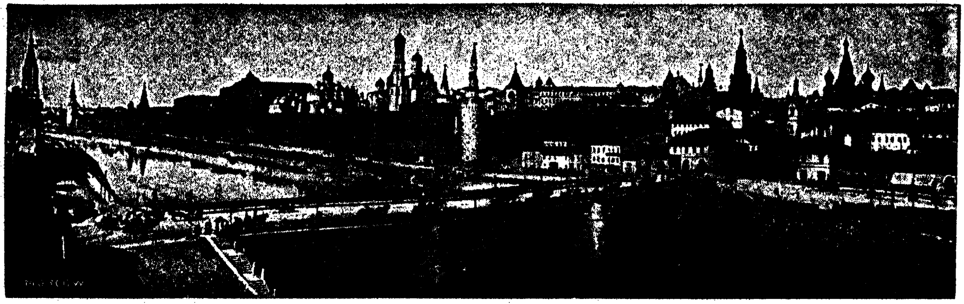
CONTENTS OF THIS VOLUME

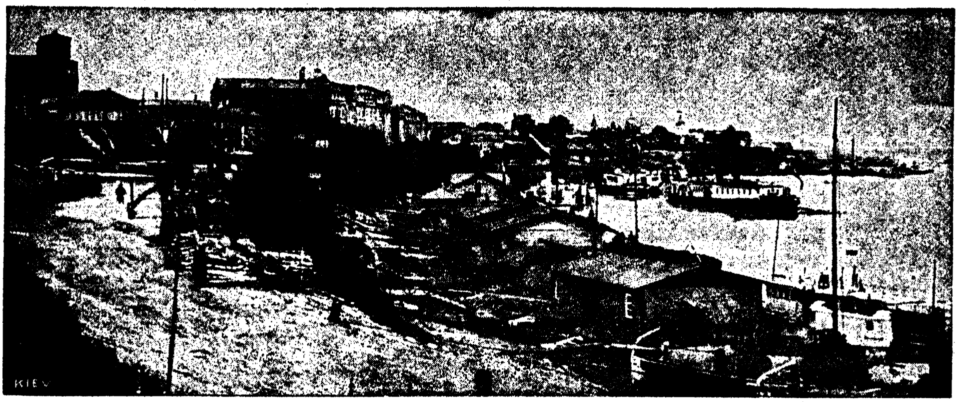
This is a short guide only to the principal contents of this volume. It is not possible to give the titles of all the Poems and Rhymes, Legends, Problems, color pages, questions in the Wonder Book, and many other things that come into the volume; but in all cases the pages where these parts of our book begin are given. The full list of these things comes into the big index to the whole work.

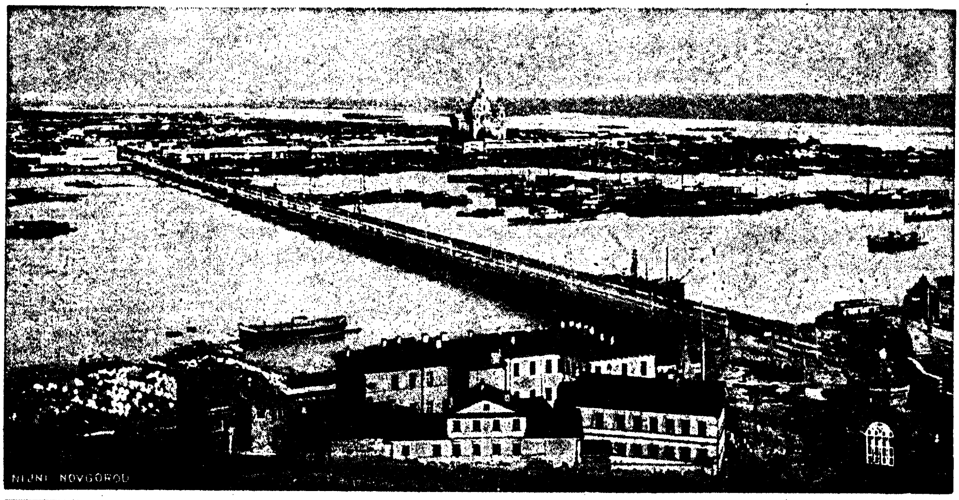
THE BOOK OF SCHOOL LESSONS

COLORED PLATES

GREAT CITIES OF THE RUSSIAN EMPIRE







Moscow is the ancient capital of the Russian Empire, Kiev is another ancient city, and Warsaw is the old capital of Poland. To the great fair at Nijni-Novgorod 400,000 traders bring $120,000,000 worth of goods.

RUSSIA AS IT IS TO-DAY

CONTINUED FROM 3729

ST PETER AND ST PAUL

RUSSIA of our day comprizes more than half of Europe, added to more than one-third of Asia, or about one-sixth part of all the world, and its climate varies from the temperate region of southern Russia to the bitter cold of Arctic winters of the north.

We have already seen how this great dominion has grown through the centuries from some small inland states about the Dnieper and Volga rivers, till it reached the White Sea, the Baltic Sea, and the Black Sea, and across thousands of miles to the Pacific, and is now three times the size of the United States. Let us now, with our maps and pictures before us, try to gain some idea of what there is to see in these 8,500,000 square miles of the earth's surface, in the country and in the towns; also, where and how the 178,000,000 people live and work.

First, from the map we gather that there are vast districts in Russia—as in the north of Canada and the middle of Australia—unsuitable for people to live in. Round the shores of the frozen sea, and on the tundras, or dreary plains, where the winter is dark and long, and the summer is short and hot, very few people live. These few people wander about with herds of reindeer, as in the north of Scandinavia; or they fish, or hunt bears and foxes for their furs, and use sledges, drawn by teams of dogs, to travel over the ice and snow. South of the tundras are miles and miles of forests, spreading darkly farther than the eye can see. For the most part, these are silent, like the icy plains, though, where transport is possible, men gather to cut down and despatch the timber, which is one of Russia's chief products.

Then, again, to the south of the empire there is a belt of land with very few people living upon it—a belt stretching from the north of the Black Sea and the Caspian Sea to the Sea of Aral, and onwards to the heights of Central Asia. Some of this land is bare save for grass, and there herds of cattle roam far and wide; some is desert and rocky, scorching hot and dry in summer, and with very cold winds in winter.

Where then shall we look for the people of these vast dominions? The majority of them are the peasants, who were serfs, or slaves, only fifty years ago, and other tillers of the soil, scattered over countless fields, where the earth is black and rich, and watered by many rivers. The

peasants, for the most part, lead dull, sad lives, and are terribly poor. Sometimes famines cause desperate starvation in the land that produces and sells to other countries great quantities of grain. The intense cold, too, also brings much suffering to the poor, for nearly all over Russia, except on the Black Sea Riviera, snow and ice last for months. Some go into the towns to work when nothing can be done in the fields; but, in most cases, the poor people paste up every cranny that lets in air to their wretched hovels, light a stove, which is kept going, if possible, night and day, and resign themselves to a sad existence, until spring comes to free them from the cold.

Very hard, too, is the lot of the many thousands of miners in Russia. These we shall find about the Ural Mountains —there is an obelisk on one of these with Europe engraved on one side, and Asia on the other—and the Altai, or Gold Mountains, in Siberia, on the borders of China, and on the various coal-fields, chiefly round the important towns of Moscow and Warsaw.

THE UNTOLD WEALTH THAT LIES BURIED UNDERGROUND IN RUSSIA

The mineral wealth of Russia is untold, and is not yet half worked; neither does it go to enrich the country nor to help pay for the costly reforms which are so urgently needed. There are iron, copper, gold, and silver among valuable metals; every variety of precious stones, marbles, and agates; and thousands of unhappy beings toil year after year, wresting these minerals from their dark hiding-places in Mother Earth's rich stores. Up to the year 1900, criminals and political prisoners, the latter of whom were sometimes only suspected of breaking the laws, were sent to Siberia as exiles or prisoners. Many were sent to work in the mines, and they generally suffered great hardships. Numbers of these people still live in Siberia, some of them in a sad state of poverty.

Others of Russia's millions are to be found by the waters that cover so much of its surface, working and building the steamers and the infinite variety of boats and barges that travel on the rivers, canals, and lakes. Others are engaged in fishing, for fish is extraordinarily plentiful, and is much needed, as there are so many fasts in the Eastern Church, when no flesh food, but only fish, is allowed to be eaten. Russia is not yet a great manufacturing country, although many iron, steel, copper, and textile works are rapidly growing up; so, at present, we find no districts densely peopled, with towns almost joining each other, as in our own cotton, woolen, iron-working, and shipbuilding centres. But there are innumerable towns in Russia, most of them very interesting, chiefly situated on the old great river highways; and more are now rising up along the vast new iron highways—the railways—that link up the north and south, and the east and west of the huge empire.

THE CITY OF PETER THE GREAT, THAT SEEMS TO FLOAT UPON THE WATERS

One of the chief routes from America to Petrograd is *via* Berlin to Warsaw, and then northward to the capital. If we choose to go from Hamburg by sea, it will take a little longer, even if we shorten the journey by going through the Kiel Canal, instead of round Denmark to the Baltic, then up the Gulf of Finland, past Kronstadt, the great arsenal and sentinel of the Neva, to the city of Peter the Great, the capital of the empire, built on the islands and shores of the Neva, as it winds into the Gulf of Finland. On our way home, we may make the long railway journey across Siberia to Vladivostock, where we may find a steamer which will bring us to San Francisco, and so our trip to Russia will have taken us all the way round the globe.

If we mount the dome of St. Isaac's Cathedral, near the centre of Petrograd, and look down on the mass of glittering water in the canals and arms of the Neva, the city seems as if almost floating upon it. The edges are lined with fine quays and docks; and barges and steamers and boats of all kinds ply busily about in every direction, for Petrograd is connected by water with the distant Black, White, and Caspian seas. But if our visit is in winter, a very different scene meets our eyes. All is frozen—the Gulf of Finland, the rivers, the canals, and the lakes.

THE SLEIGHS WITH THE TINKLING BELLS THAT RUSH OVER THE FROZEN LAKES

The ice is strong enough to bear carriages of every description; and rich folk, wrapped up to the eyes in costly furs, glide swiftly along in sleighs, some-

THE PEOPLE OF EUROPEAN RUSSIA

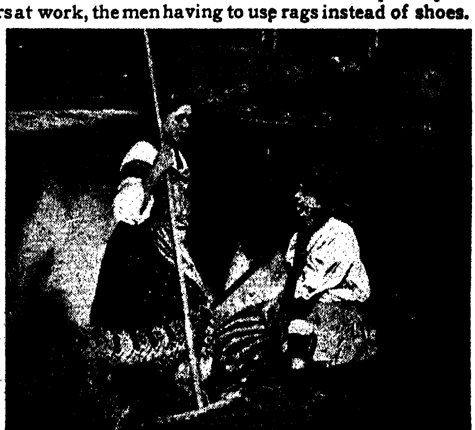
Here is a Russian gipsy girl. There are fewer gipsies in Russia than other countries.

These are peasant girls of Little Russia, that part of the Russian Empire in Europe that includes the important town and province of Kiev.

This moujik, or peasant, girl belongs to the province of Tver, north of Moscow.

The mass of the people of Russia are very poor, their despotic and selfish Government grinding enormous sums from them in the way of taxes, a large proportion of which is wasted or embezzled. The poverty of the people can be seen from this picture of road-menders at work, the men having to use rags instead of shoes.

The people of the Baltic provinces are more intelligent than other Russians, owing to their contact with the rest of Europe. Their character and dress may be seen from this picture of an Esthonian girl.



Peasant girls of Lithuania, the country formerly included in the ancient kingdom of Poland, but now known as Western Russia. The girls are shown in the picturesque costume in which they usually work.

times with three horses abreast, tinkling their bells, over the ice and snow, to enjoy all the balls and theatres and parties of the gay winter season. French is freely spoken by the upper classes in Russia, as other Europeans find it very difficult to learn to speak the Russian language. Between St. Isaac's and the Neva is the statue of the founder of the city, with the English quay on one side and the Admiralty buildings on the other. From the Admiralty the three chief streets, or prospects, radiate in straight lines. The Nevski Prospect, like the Unter den Linden of Berlin, is one of the finest streets in Europe. The Kazan Cathedral is in it; and at its end is one of the most celebrated monasteries in Russia—that of St. Alexander Nevski.

THE WONDERFUL CHURCHES OF RUSSIA, COVERED WITH GOLD AND JEWELS

It is difficult for us, who are used to plainer houses of worship, to realize the exceeding richness of the decorations in Russian cathedrals and churches. Not only are they adorned with marbles, agates, jasper, green malachite, blue lapis lazuli, and fine work in gold and silver, but there are many sacred pictures, often set with diamonds and other precious stones, and beautiful embroidered hangings, and many other works of art. The services held in these magnificent churches are very grand and solemn.

Next to the Admiralty is the famous Winter Palace, joined to the Hermitage, built by Catherine the Great, and beyond that is the Summer Garden and Palace. In these palaces are stored treasures of pictures, painted by the greatest artists of the world, and also most valuable and interesting collections which illustrate every part of Russian history.

The great library, in the Hermitage, contains more than a million books, besides an important collection of manuscripts. Among them are letters from Mary Stuart, Henry VIII., Elizabeth, and Charles I.; and there is a writing exercise of Louis XIV. in French, "Homage is the right of kings; they do what pleases them." No wonder the boy grew up to declare proudly, "I am the State."

THE SIMPLE COTTAGE OF RUSSIA'S GREATEST RULER

Just opposite these palaces, across the Neva, is the fortress and cathedral of St. Peter and St. Paul, the burial-place of the czars. Peter's boat, "the grandfather of the Russian Navy," in which he sailed about and gained much practical skill, is housed near the cathedral. Close by is the interesting cottage where "the giant wonder worker," as Peter was called, lived on the banks of the river while superintending the building of his city. Two rooms and a kitchen were all he required.

In the Artillery Museum is Peter's carriage with which he measured roads, the number of revolutions made by the wheels being registered by the machinery in the box behind—a sort of meter. On the lid of the box is a picture of Peter traveling, with forests in front of him, and newly built houses and newly laid-out gardens behind him.

There are many manufactories round Petrograd, which also has a large trade, chiefly in produce—timber, tar, hemp, sugar, and beetroot—from the forests and plains close by.

MOSCOW, THE CITY OF GILDED SPIRES AND PAINTED DOMES

We could spend months in Petrograd and not come to the end of all the treasures to be seen in it—treasures from which we can learn much of the story of Russia and its peoples without opening a book; but the whole country lies behind it, and we must hasten on to Moscow, the ancient capital, 400 miles south-east of Petrograd. Moscow is now the centre of the railway system of Russia, though the old water routes which connect it with distant parts are still much used.

Over two million people live in Petrograd, and over a million in Moscow. The older city is the centre of a great cotton trade, and there is a large coal-field in the neighborhood.

South of the city, where the Moskva river makes a great loop, are the Sparrow Hills. It was from here that Napoleon, surrounded by his staff, surveyed the glittering city at his feet. Thousands of housetops, and trees, and the winding river lie before us, but above all stand out the gilded and colored domes of the cathedrals and churches and the grim walls of the numerous monasteries. We have already glanced at the history of this bustling and busy city, and now we must visit the Kremlin, which is the Tartar name for a fortress. The Kremlin

In this view of Moscow we see the cathedral of St. Basil, one of the strangest buildings in the world. It has twenty gilded domes and towers, all of different shapes and sizes, and has been called "a nightmare in stone." This curious style of architecture is distinctly Russian, and similar churches are dotted over Russia.

Petrograd was built by Peter the Great, who drained the marshes of the River Neva by cutting canals, and so provided solid ground for the foundations of his new capital. Here we see the Nevski Prospect, the finest street in Petrograd. It is three miles long and very wide, and is lined with fine shops and public buildings.

itself consists of a mass of buildings on the higher bank of the Moskva River, shut in by a wall, with towers and gates. It is, to Russians, one of the most sacred spots, for here are the Synod buildings, where the Council of the Russian Church meets in solemn state. Here are the ancient garments, some richly embroidered with pearls and precious stones, and the jeweled mitres worn by the patriarchs of the Eastern Church. Here, too, in the Cathedral of the Annunciation, the czars have been baptized and married, and in the Cathedral of the Assumption all the czars from Ivan the Terrible have been crowned; in the Cathedral of the Archangel Michael, the old czars, down to the time of Peter the Great, were buried. After Nicholas II. was deposed a great national conference was held in Moscow to try to restore order to the nation, which had fallen into great confusion.

Many and greatly revered are the relics and sacred pictures called ikons, and treasures of jewels and gold and silver, to be found in the various buildings of the Kremlin. In the Tower of Ivan the Great are the famous bells which are rung on Easter Eve with such wonderful effect. The enormous "King of Bells," which is 19 feet high and weighs 198 tons, stands at the foot of the tower, with a piece knocked out of its side weighing eleven tons.

THE WEB OF STREETS THAT HAS BEEN SPUN AROUND THE SACRED KREMLIN

All round the Kremlin lie streets arranged like a spider's web, and there are many rich monasteries and great churches and fine houses, and beyond are the factories of all kinds and the hovels of the workers.

It is easy now to pass by train to Kiev on the Dnieper, the mother of Russian towns, and, indeed, one of the most ancient towns in Europe. It has many fine old cathedrals, and also important trade and manufactures. Its companion, Novgorod the Great, near Lake Ilmen, called the cradle of the Russian Empire, bears many marks of its ancient and important history, dating from the times of the Scandinavian Rurik. Here, in 1862, a monument was erected to commemorate the 1,000th birthday of the Russian Empire.

Nijni, or Lower, Novgorod, on the Volga, is also a place of much interest, chiefly on account of the great fair which is held there every summer. It is said that the value of the goods brought to the fair for sale amounts to about $120,000,000; shops and bazaars, and all sorts of buildings cover a large space of ground, and the wares set out in them come from every part of Russia and beyond. There are iron goods from Tula, near Moscow, the Russian Birmingham and Sheffield combined; silks from Persia; precious stones and furs from Siberia and Central Asia; tea from China; rich carpets, dried fruits, cotton goods, silver ornaments, and all sorts of wooden boxes and toys made by the peasants.

HOW EAST MEETS WEST IN THE CITY OF THE GREAT FAIR

The wharves of Nijni Novgorod, where most of this merchandise is unloaded by sturdy Tartar laborers, are quite ten miles in length; and the various types of people seen selling, buying, and looking on, show that here Europe and Asia meet and trade.

Steamers ply regularly on the great rivers, such as the Volga, now a peaceful highway of commerce with numbers of towns on its banks, and united with the distant seas by its tributaries and connecting canals. Its course approaches to within forty miles of the Don. Many are the stories of fierce warfare and pirates connected with the great rivers of South Russia in the past. Astrakhan is the port near its delta in the Caspian Sea, the headquarters of the large fishing industry carried on in that inland sea.

Odessa, on the Black Sea, is the great port of the South for sending away the grain grown in the fertile parts of Little Russia. Wool is exported from the steppes round the Black Sea, and there are many engineering and shipbuilding works in the neighborhood of this thriving city.

A MIGHTY MOUNTAIN, AND A SPLENDID ROAD ABOVE THE CLOUDS

Railways now run down from Moscow and other parts of Russia to the Caspian Sea, skirting the eastern edge of the Caucasus Mountains, which form such a high barrier between North and South. The highest peak, Mount Elbruz, tops Mont Blanc by about 3,000 feet. There is a splendid military road over the Dariel Pass, rising at parts into the clouds, with scenery like that of Switzerland. White peaks against the blue

THE STRANGE PEOPLE OF LONELY SIBERIA

The people of Siberia are a mixture of many races that have from time to time conquered or migrated to this lonely land. The people shown in this picture are Tungusians, a race that lived originally in Manchuria, but wandered south, east, and north into Siberia, their character largely influencing the peoples they conquered.

The Yakuts, shown in winter costume, are another race that went into Siberia from the south. They are more hardy and industrious than the Tungusians, through whose territory they fought their way.

Another Siberian race is that of the Giliaks, who live in the Amur valley. They are an ancient race, and related to the Ainos, the early inhabitants of Japan. In this picture we see a Giliak woman and her child.

The Yakuts, seen here and in the picture above, are huntsmen and cattle-breeders. In the cold winter months they live in curious houses like that shown here, with sloping walls made of wood, covered with clay, the roofs being of clay and peat. In summer they live a good deal in tents and in the open air.

sky, dashing torrents, glaciers and avalanches, all seem especially beautiful after the bare steppes and rocky deserts that are found not far off. Baku, on the Caspian Sea, famous for its rich mineral oil wells, is connected by the line that runs through Tiflis with the port of Batoum on the Black Sea.

RIVERS OF OIL THAT RUN THROUGH PIPES SIX HUNDRED MILES LONG

There are special boats and trains to convey this never-failing oil from the wells whence it springs, but, in addition, pipes are now laid, through which pour daily over a million gallons of oil, straight to the tank-boats and reservoirs at Batoum about 600 miles away.

The rail now pushes on beyond the Caspian Sea, and links together the fertile oases which lie like green islands in a sea of sand, watered by rivers which afterwards lose themselves in the surrounding dry and rocky soil. In these oases, rice, wheat, and fruits are grown. Here, in Russian Turkestan, most of the people are Mohammedans, and numbers lead a wandering life, keeping camels, cattle, sheep and horses wherever sufficient pasture can be found on the dry and barren steppe lands.

But the greatest achievement in linking together the far distant parts of the great empire by means of the iron rails is the Siberian Railway, from Moscow right across Asia to the Sea of Japan, an arm of the Pacific Ocean.

This railway reminds us, in some ways, of those that run across America. It is longer, and much of the scenery is dreary and flat, and often it runs through endless forests. It crosses over the Ural Mountains near Ufa, a district famed for iron mines and foundries, as well as for its riches in gold and precious stones.

THE LONGEST AND ONE OF THE MOST MARVELOUS RAILWAYS IN THE WORLD

There are no tunnels, and there is none of the exciting, hairbreadth travel that the great lines of the North-west furnish among the Rocky Mountains. In winter it is so cold on the Siberian line that meat, butter and fish need no refrigerating cars. The water for the engines has to be heated in winter, or it would freeze on the way.

A great feature of this line is the number of bridges needed. One that crosses the Volga near Samara is nearly a mile long, and many more are passed on the way through West and East Siberia, crossing over the immense rivers that drain so slowly and quietly across Siberia from the South to the frozen Arctic Sea. The Obi, the Lena, and the Yenisei are all, like the Volga, over 2,000 miles long; so is the Amur, which flows east to the Sea of Japan; and many of the tributaries which join the Arctic rivers are long and important, and have helped much in the development of the country. In West Siberia the railway runs through a belt of very fertile black earth, like that in Little Russia, where wheat is grown, and immense dairy farms are rapidly developing.

Thousands of settlers from other parts of Russia are brought every year by train to fill up the vast silent tracts of Siberia. The line runs past Omsk and near Tomsk, past Irkutsk, round the south of Lake Baikal—a most difficult piece of engineering; then onwards through Manchuria, which belongs to China, to Vladivostock, with some branch lines.

THE MONSTERS OF A PAST AGE WHOSE BODIES ARE PRESERVED TO-DAY

Many towns are growing up on the line, both trade centres and mining towns. Omsk is the centre of the agricultural industry of Siberia. At Irkutsk, the largest town in Siberia, are gold-smelting works, besides other industries, and a university.

The coldest place in the world is on the River Lena, where the difference in the winter and summer temperatures is the greatest known. There are islands in the Pacific where the temperature is almost the same all the year round.

At the mouth of the Lena, and in other parts of the Arctic shores, the remains have been discovered of mammoths with long, wooly hair, frozen hard in the icy mud by which they were suddenly overwhelmed ages ago. Their flesh, when first exposed, was actually eaten by the wild animals prowling around. Some of the monsters have been preserved and set up in various museums, and interesting photographs have been taken of these creatures, so miraculously kept for centuries after all their kind had disappeared from the earth.

There is a large trade in ivory from the tusks of these prehistoric animals found in the New Siberian Islands, which lie off the mouth of the Lena.

It now takes more than a week to travel the 5,000 miles between Moscow and Vladivostock, and the last part of the line is full of reminders of the dreadful war between the Russians and Japanese in 1905, when Russian soldiers were brought across Asia by thousands on the Siberian Railway, to perish miserably in the struggle. The Russian Navy was practically destroyed near Port Arthur on the Yellow Sea.

Many strange-looking people are seen at the stations along the Siberian line—Chinese, Mongols, Russian emigrants, and wild people of the steppes. Some of these join the Siberian line, where it crosses the Urals, from the railway that runs through Orenburg, on the Ural River, from Tashkent, beyond the Sea of Aral, which, again, is joined to the Trans-Caspian line. Much trade with Central Asia comes this way.

The Urals run for over 1,000 miles to the Arctic shores, and form a great storehouse of mineral riches. Dreary plains of snow and ice in winter, and damp swamps in summer, lie between them and Archangel, on the White Sea, which for long was Russia's only port.

It is now connected by rail with Petrograd, and, in spite of its remoteness and the ice which closes its harbor for so many months in the year, vessels still trade there for oats, tar, and lumber. Peter the Great took much interest in developing this port. He built a quay and a fortress some miles off. The cottage in which he lived is still shown; also two of his boats, one built in England.

It is easy to reach Finland from Petrograd; and many visitors are attracted there to fish, and boat, and bathe, for the clear lakes are delightful, and the scenery, with its woods and streams, is very pretty. There is enough fall in many of the streams to give water-power for various purposes, such as sawing and wood-pulping, and the towns are numerous and interesting, and most of them are full of reminders of Swedish days. Helsingfors, the capital, was founded by Gustavus Vasa in the sixteenth century, and it has a Senate House and a university. Abo is a busy place, with much trade, and has an interesting cathedral, dedicated to the English St. Henry. The Finlanders are highly educated, and are deeply interested in reforms and good government, and in finding out the best ways of living. Finland is one of the countries where women are counted as citizens, and are allowed to help to choose the representatives who settle public matters, as well as men. There are a number of women representatives in the legislature.

THE AUTOCRATIC RULE OF THE CZAR

After the death of Alexander II., as we have seen on page 3729, he was succeeded by his son, Alexander III., who had married a Danish princess, an aunt of the present King of England. The new emperor had been inclined toward a liberal rule, but the manner of his father's death turned him to harshness. He refused to let the country have the constitution that his father at the time of his death was about to give, and the reign of Alexander III. was marked by a system of spying, which put a terrible weapon into the hands of the police. He tried, too, to force the Russian language on Finland, and on the Baltic provinces where Swedish is spoken, and because of his desire that all the people should belong to the Greek Church, the Jews in the empire were bitterly persecuted. Large numbers of political prisoners were sent to Siberia every year, sometimes only on suspicion, and the Russian government gained a reputation for intolerance, injustice, and oppression.

THE RUSSO-JAPANESE WAR AND THE STRUGGLE FOR FREEDOM

Alexander III. died in 1894, and was succeeded by his son Nicholas II., the last of the Czars. Nicholas at first continued the same hard despotic rule as his father, but gradually the voice of the people made itself heard, and although the laws were not changed for a long time, they were less harshly carried out.

In 1904 the Russo-Japanese War broke out, and resulted in the defeat of Russia, and the almost total destruction of her fleet. As we have read on page 346, peace was made by the mediation of President Roosevelt, and was signed at Portsmouth in New Hampshire in 1905.

The heart of the people had not been in the war: they were too much engaged in the struggle for freedom which for years had been going on, and about the time that peace was signed, the Czar decreed that the country should have an elective legislative council called the Duma.

The Duma did not at first work

smoothly, of course. Naturally, the Czar wanted to keep as much power as possible, but by degrees things improved. The officials began to see that they could not always hold down the great mass of people. The Duma gradually gained more power, and many steps were taken in the direction of greater freedom, though under the Czar the Duma had nothing like the powers held by the legislative assemblies in free countries.

In 1905, Finland got back her own legislature, which had been taken from her, and this part of Russia had more freedom than any other part of the empire.

Much misery has been caused in Russia by an intoxicating drink called vodka, which was manufactured by the government in great quantities.

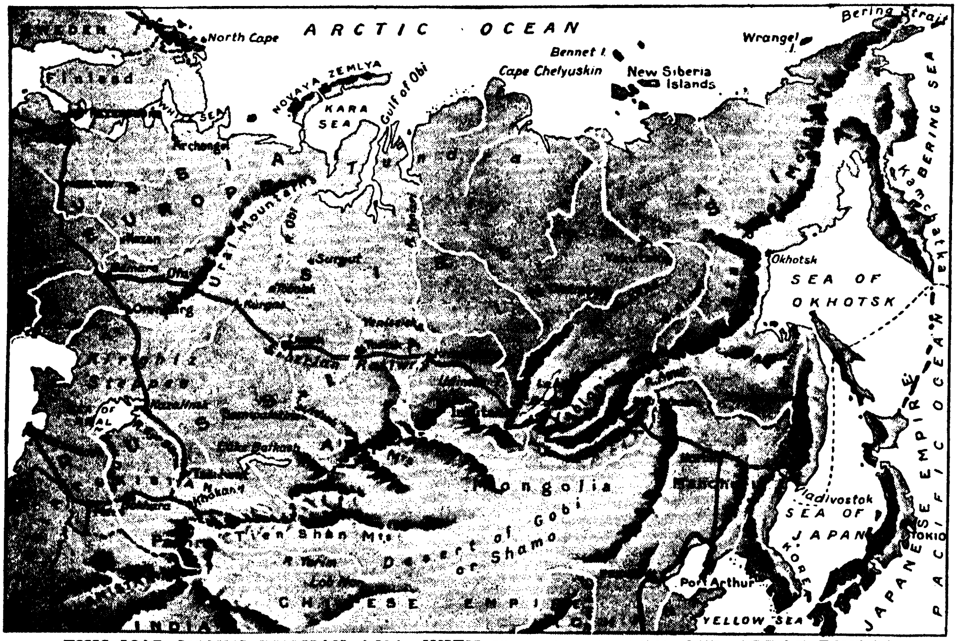
When the Great War broke out, it was seen that Russia could not do the things that her Allies required of her, if many of her people were much of the time intoxicated. Therefore, the Czar made a decree that the manufacture of vodka should stop, and that the supplies should be destroyed. This decree has proved to be one of the greatest blessings ever given to the Russian people.

In the early part of the Great War the Russian armies were successful, but later on were defeated and had to retreat. The conduct of the war was mismanaged, and many people said openly that members of the government were in the pay of the Germans.

Early in 1917, the Czar issued a decree, dissolving the Duma, which the Duma refused to obey. Food riots in Petrograd ripened quickly into revolution, and the Czar, who was accused of being in treaty with the Germans for peace, was forced to abdicate. He and his family were imprisoned, and later on were sent into exile in Siberia.

A Republic was proclaimed and a provisional government was formed. At first the new Republic seemed to be working smoothly, but the people became intoxicated with their new freedom, and the nation fell into wild disorder. The people, however, gave large powers to Vladimir Kerensky, one of the revolutionary leaders, in the hope that he might be able to restore order, and, though the country is still in a weak and disunited state, friends of the Russians have confidence that they can build themselves up into a strong nation.

To give the new government help and encouragement, the United States sent a special commission to Russia in the summer of 1917, and the members of this commission brought back firm faith in the people and their institutions.

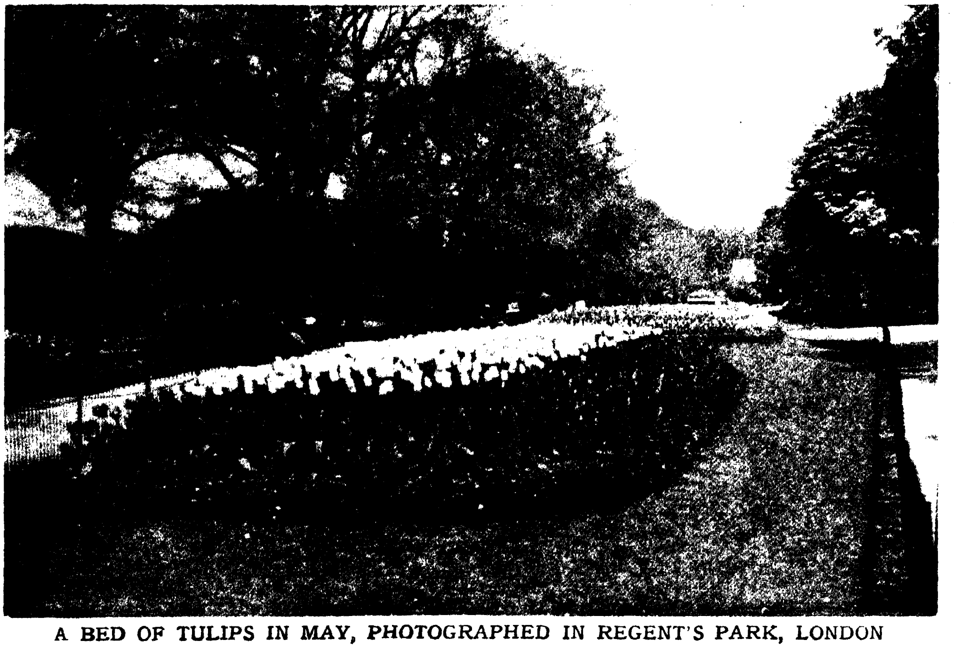


THIS MAP SHOWS RUSSIAN ASIA, WITH ITS VAST PLAINS AND GREAT RIVERS

THE NEXT STORY OF COUNTRIES IS ON 3855.

THE GLORY OF THE FLOWERS
IN PARK AND GREENHOUSE

The world would be a dark place without its flowers. From the tiny forget-me-not and the chaste and fragrant lily to the massive yet delicate chrysanthemum and the blazing sunflower we have every shape and form and color and perfume. Singly or massed together, the flowers present a beauty that no artist can equal. In these pages, which show the flowers of the park, and the greenhouse, we see Nature in her lovely dress, but sights equally beautiful may be seen in the fields and woods, or beside the streams.



A BED OF TULIPS IN MAY, PHOTOGRAPHED IN REGENT'S PARK, LONDON

A FINE SHOW OF HYACINTHS, GIVING OUT A WEALTH OF RICH PERFUME

CHRYSANTHEMUMS IN THEIR NATURAL COLORS

THE STRIKING BEAUTY OF THE CHRYSANTHEMUM AS SEEN IN A GREENHOUSE

PLANT LIFE

WE have read the story of Animal Life, and we come now to the other great division of living things—Plant Life. Nothing is more wonderful than the flowers and plants that grow everywhere, filling the air with sweetness and making the earth beautiful to look upon. The story of the flowers is a story that never ends; we can never tell half of the wonderful things that are to be told about them. Some flowers are so small that we do not see them. The wind, the birds, and the beasts carry the seeds over the earth, and we can never grow tired of learning about the ways in which the flowers spread themselves. Some flowers throw up their seeds for the wind to catch and blow away; and all flowers have a wonderful cleverness in spreading themselves over the world. We read in this part of our book about the beautiful way in which Nature does her work, and we learn the story of the familiar flowers and plants of the garden and the countryside that delight us so.

HOW A FLOWER IS BORN

WHAT NATURE DOES TO KEEP THE PLANTS ALIVE

CONTINUED FROM 3750

By EDWARD STEP

WHAT is a plant? That is a question not easy to answer without using many strange words; but in most cases it is perfectly easy to tell a plant from an animal or a mineral.

If we were to see a rose-tree, a dog, and a stone, we should be able to tell at once that the rose-tree is a plant, the dog an animal, and the stone a mineral. But there are some plants that we might think were just stains on the rocks; there are some others, very small, that we might think were animals if we saw them moving through the water; and there are some kinds of animals that we might think were plants.

Many years ago we were taught that animals and plants differ from stones because they live, and that an animal differs from a plant because it *feels*. To-day we know that many plants can feel. The plant is a living thing. It has no hands, no feet, no wings, yet it can move; and some plants can take hold and climb. It has no eyes, yet it can tell darkness from light. Some plants can even catch and feed upon insects. The plant can make starch, and sugar, and fat, and many other things out of air, water, and things it finds in the earth. It breathes.

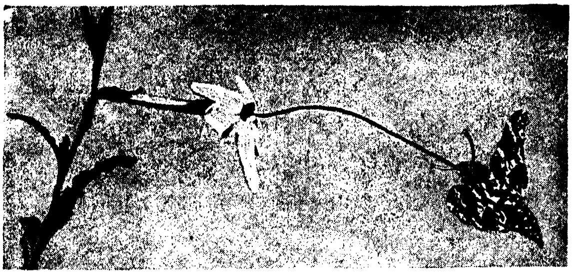
There are several names for plants of different sizes or uses. There are trees, shrubs, herbs, vegetables, grasses, ferns, mosses, and toadstools; but they are all plants of different kinds.

Let us talk a little about all these kinds of plants, and see how they get their living. We ought all to know the great work the plants are doing for us. They make the lovely flowers we are so pleased to look at and to gather when we walk in the country lanes. But that is a very small part of the work they do for us. They give us nearly all our food and much of our clothing. They give us pure air; and, indeed, we could not live if there were no plants. Think what the world would be like without plants! I am sure we should say that it was a strange and dull world.

Before plants appeared upon the earth, the world must have been just a great ball of bare rock, with the sea and rivers in the hollows, and in the waters there may have been seaweeds. At first, the only place where grass and herbs could grow would be along the seashore, where the waves in great storms had broken off pieces of rock and ground them into sand.

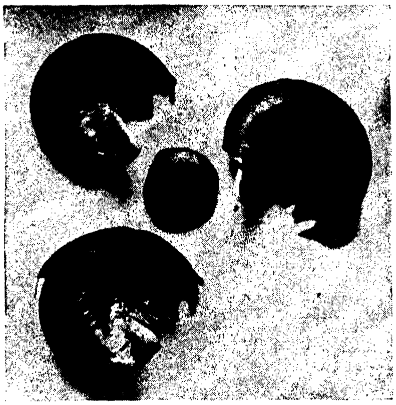
Herbs and shrubs and trees want mold in which they can fix their roots, and mold has to be made by the plants themselves. How could plants make mold if there were no plants? we may ask. The first plants must have been very tiny ones without roots, and from the dead bodies of these enough mold

would be made in which moss or grass could manage to thrive. If we go out in

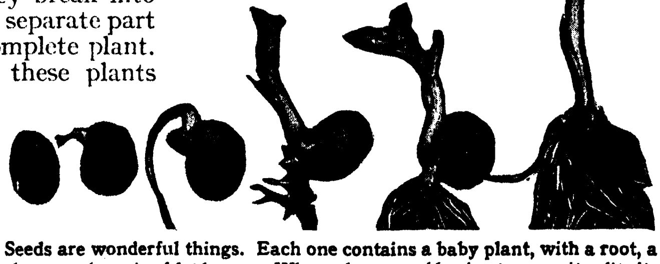


Insects carry pollen, a yellowish flower-dust, from flower to flower, and it is this dust that makes the seeds form. Here we see a long-tongued moth which carries pollen to a tobacco plant. Without this the plant could not give birth to other plants.

winter, when there is a great deal of damp about, we shall notice patches of bright green on old fences and trees. This is made up of hundreds of thousands of tiny plants, so small that if we could place 3,000 of them in a row, so that they touched one another, the whole row would only just about reach across a nickel. Let us examine the small dot over this i. That dot, small as it is, is many times larger than one of these tiny plants, which have no roots, no stems, and no leaves or flowers. Each plant is, in appearance just like a little round bubble, usually green, but sometimes red, and filled with fluid. If we were to take the smallest drop out of a rain-water tub, and look at it under a microscope, we should see hundreds of them. We shall find them in almost any little pool, where they feed upon the rain-water. When they have grown to their full size they break into two or more parts, and each separate part becomes round, and is a complete plant. When the pool dries up, these plants dry into a little dust, and the wind takes it through the air, and some of it sticks wherever the wind passes over a damp surface. Then the little dried-up plants soak up the moisture and begin to grow again. Of course, some of them die from old age, and their bodies decay. The wind also carries the seeds of mosses, and leaves some of them on such damp patches, where they grow. The lower parts of the mosses die, and make more mold. Then the living mosses on the top catch dust from the air, and with it come the seeds of ferns and other small plants, which now find mold deep enough to root in. Their roots find their way into chinks of the rock, and as they grow thicker they are strong enough to break up the surface of the rock. In time, we shall see, there will be a sufficient depth of mold for shrubs and trees, whose seeds may be carried far away by the wind, or dropped in distant places by birds as they travel on their annual flights from land to land. In this way the plants slowly covered up the bare rocks with their growth, and made it a place where insects and birds and grass-eating beasts could live. And after many, many years, men and women and children lived there, and found food and fruit and beautiful flowers growing up from the soil for their use and delight. If we were to be asked where we get our food and clothes from, we should say that our mothers and fathers



The seed of the Sand Box grows inside a skin, which bursts when ripe, and scatters the seeds.



Seeds are wonderful things. Each one contains a baby plant, with a root, a shoot, and a pair of fat leaves. When a bean-seed begins to grow it splits its jacket, and a little white shoot pushes into the ground. That is the root. Then the seed-leaves fall apart, leaving the plant to grow as shown in the picture.

give them to us. That would be quite true; and we know that they first get them from the butcher, the baker, the grocer, the confectioner, the tailor, the shoemaker, and so on. But these tradesmen only prepare the things we need. The true answer is, our food and clothes come really from the plants. The meat comes from the ox and the sheep, but these build up their bodies by eating grass. The baker's flour is the crushed seeds of wheat; the tailor's cloth is made from the sheep's wool; the shoemaker's leather is made from the skin of the ox; the merchant's linen is made from the stems of the flax plant.

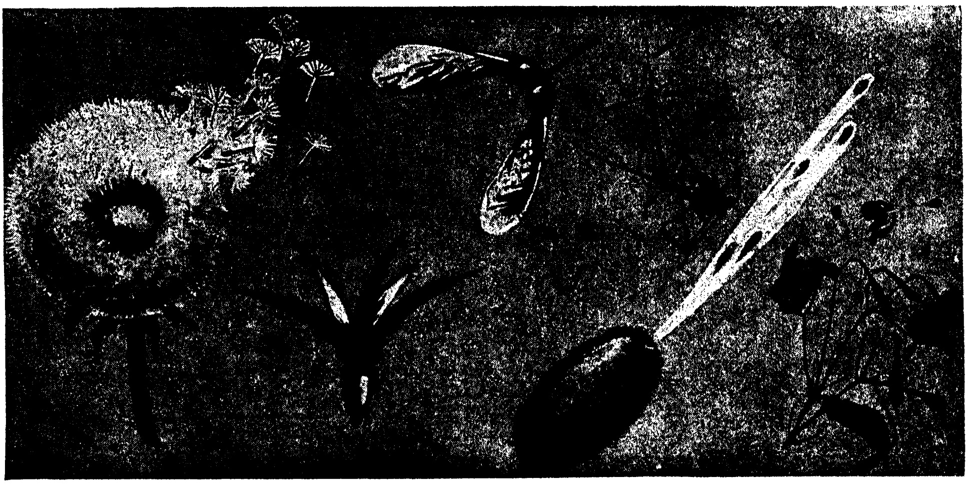
Everything we need comes, in the first place, from the plants, and the plants make it all from air, and water, and rocks. Every breath we breathe *out* is poison to us, but the plants take the poison out of it, and make it fit for us to breathe *in* again.

If we were to place the wisest man upon an island where there were no plants, but plenty of rocks, air, and water around him, do we think he could make food and clothing out of them? We are sure he could not, even if he were the wisest man that ever lived. But the plants do it. And not only do they give us bread and milk, meat and potatoes, but juicy fruit and sweets to eat, clothes to wear, and lovely flowers to look at. Though plants have no hands or feet, and cannot talk, they must be very clever creatures to be able to do what man, with all his wisdom, cannot do.

In many of their ways plants are much like animals. They all try to get what are for them the best places. All the plants with green leaves need plenty of sunshine, and the trees in a forest are so afraid that their neighbors will shade them that they put out new shoots only at the top, to reach up as high as they can. Some plants are so good to eat that they have to cover their lower shoots, or leaves, with sharp spines, to prick the noses of animals that would eat them. Some make poisons instead of spines, and spread them in their leaves, so that no animal that has once tasted them wants to do so again. Others want bees to work for them, and these provide a sweet drink to attract.

What we call seeds are the eggs of the plant, and some of the plants like their seeds to be taken away where they will have more room to grow than if they dropped close to the old plant. So these plants fit each seed with a sail, that the wind may carry it off, or with hooks, which can be fixed in the coat of any bird or beast that passes by. Others shoot their seeds to the proper distance; but some that grow in less crowded places drop their seeds around them, so that their young ones may

SOME OF THE STRANGE WAYS IN WHICH PLANTS SPREAD THEIR SEEDS



Some plants send their seeds to grow far away from the mother plant, and these seeds have downy tops, like the dandelion, on the left of the picture, or claws, like the starry-headed trefoil, next to it, or wings for the wind to carry them, like the maple-seed, which is seen higher up. Others have hooks to fix in the wings of birds or the coats of animals, and some, like the squirting cucumber, shoot their seeds some distance.

be able to grow up under the shelter of the parent plants. Now, these seeds are all very wonderful things. Each one of them contains a baby plant, with a root and a shoot and a pair of fat leaves. These seed-leaves are fat, because they are the pockets of the little plant, whose mother, before sending her baby plant away, has filled its pockets with enough food to feed it until it has its root firmly fixed in the ground, and its shoot growing up to the sun.

If we soak a bean-seed in water for a day, then lay it on moist earth in a flower-pot, and put it in a warm place, this is what will happen. The bean will soon begin to grow, and the first sign that it is growing will be the splitting up of its jacket, which has become too small for it. As the slit widens we shall be able to see that the real seed inside is in halves, joined together in only one small place. These halves are the bean's pockets filled with food, and between lies the baby plant. In a few days a little white shoot pushes out, and as it grows longer its pointed tip bends to the mold and pushes into it. That is the baby bean's root. When it is far enough in to get a good hold of the soil, it lifts up the bean, which had been lying on its side. Then the fat seed-leaves fall apart, and in between them we see a pair of very tiny leaves with their edges folded together. These little leaves grow very fast, and are soon as big as one's hand, and as they grow large the fat seed-leaves get small and wither. We see that the baby bean is eating up its food and its pockets are becoming empty. But now it has got those large green leaves it will be able to work for itself, and get all the food it wants from the mold and the air. And that is how the mother plant sends her baby away—always with enough food to last until it is old enough to get its own living.

Now that we have seen what a seed really is, let us have a short talk about how seeds are formed. We must know that the great object of every plant is to be able to ripen seeds, in order that the race may not die out. To ripen seeds the plant must first have flowers; and the plant's sole excuse for devoting so much of its energy and substance to the making of showy blossoms is that it must, at any cost, produce seeds.

Many plants, such as we call annuals and biennials, because they come up every year or every two years, ripen their seeds and then die. They have given their lives to this effort, and, the work being done, they die.

If we were asked which part of a flower we thought of most value, we should almost certainly point to the brightly colored petals, and say "These!" But we should be wrong.

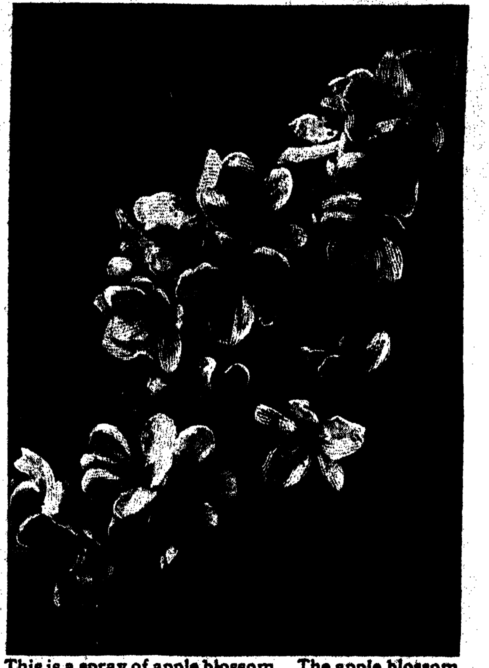
A PLANT THAT CATCHES FLIES

This plant, the Venus Fly-trap, opens its leaves to tempt insects inside and then closes them and traps the insect.

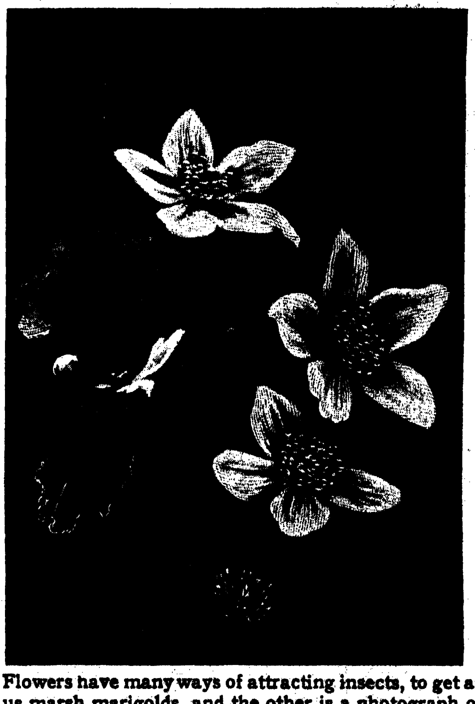
The petals are of great value to the plant, and it pours its richest colors into them to make them as bright and showy as it can. Yet there are some flowers that have no petals. The most important parts of a flower are the green and yellow pins and threads in the centre; the parts that are often hidden by folds of the petals; the parts that some people think a fault when they appear in double garden flowers. Where there are bright petals they do not exist solely to make us pleased with the flower, but in order that insects shall be able to see the flower from a distance, and come to it, to help the plant to form its seeds. To induce the insects to come many flowers are fitted with little glands that pour out from their surface a sweet fluid called nectar, and they also give out a sweet scent, which bees, butterflies, and moths look upon as a notice that sips of nectar may be had, free of cost, if they will follow up this scent to the bright-hued flower. The flowers that do not want the aid of the insects have small shabby petals, or no petals at all. Now, the plant that wishes the bee, the moth, or the butterfly to come to the flower, takes care that this nectar shall not be reached by ants, or beetles, or common flies; and hence all sorts of devices are used by the plant to guard its nectar from such

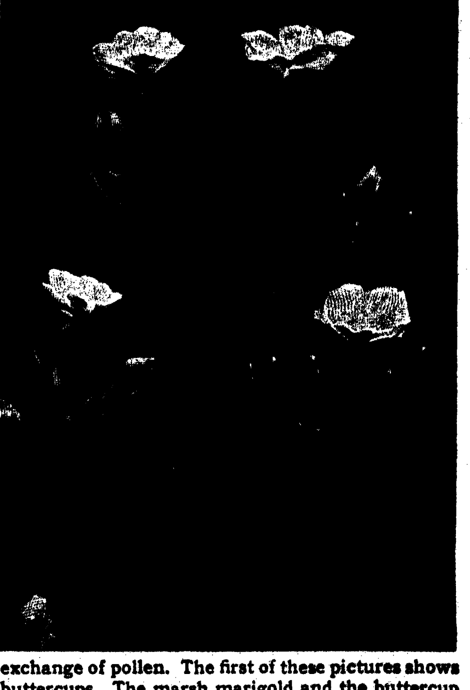
HOW FLOWERS INVITE THEIR LITTLE GUESTS

If we look at this picture of the honeysuckle, or woodbine, we shall see the pins and threads standing out from the mouth of the trumpet-shaped blossom.



This is a spray of apple blossom. The apple blossom, like the buttercup and marsh marigold, attracts insects, and gives them nectar in return for pollen.



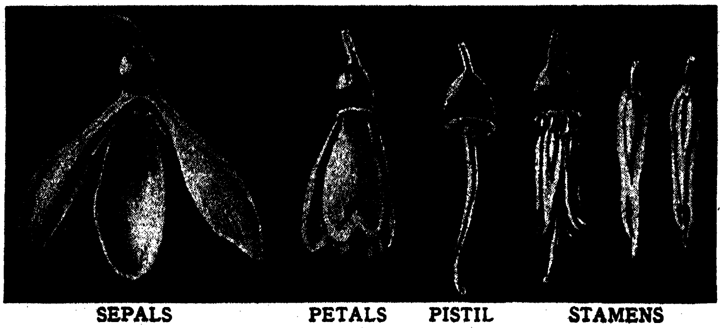


Flowers have many ways of attracting insects, to get an exchange of pollen. The first of these pictures shows us marsh marigolds, and the other is a photograph of buttercups. The marsh marigold and the buttercup seem to say to insects that all will be welcome, for they hold the nectar in little cups where all can reach it. The marsh marigold has large leaves after fertilization, but during the flowering period the leaves are quite small, so that they may not conceal the blossoms from insects that must visit them for fertilizing purposes.

robbers. The columbine and the garden nasturtiums have long, hollow tails, and the nectar is poured out at the bottom of these, so that only insects with long, thin tongues can reach it. The honeysuckle has long, trumpet-shaped flowers with nectar at the bottom.

But the tongues of moths and butterflies have grown into long, hollow tubes like the trunk of an elephant, and they can reach the nectar with ease. On the other hand, there are many plants that do not want bees or butterflies, preferring the visits of beetles and flies. These spread their nectar on flat, open parts of the flower where these short-tongued insects can lick it up. But the long-tongued insects are not too proud at times to take a drink at these flowers. English ivy has flowers of this kind; and in autumn, in places where it grows, swarms of bluebottles may be seen, greenbottles, bees, and butterflies, all crowding around the flat dishes on which the ivy has spread her nectar.

Flowers like those of the carrot spread their nectar on flat plates for the beetles and flies, so the butterflies pass them by as being too much like a fox's feast. Some plants, like the buttercups and marsh marigold, seem to say to insects in general that all will be welcome, for the nectar is held in little cups, in open flowers, where all can get at it without trouble. Some plants, like the foxglove, have so adapted their flowers to the shape and size of the humble-bee that no other insect can get at the nectar; for though it seems easy for small creeping insects to crawl into the large bell, their way is blocked by stiff hairs that are easily pushed aside by the strong bee. We have not yet learned *why* the flowers are so anxious for these insects to come that it is worth their while to attract them by bright petals and sweet scents, and then to reward them with nectar. If we look at the honeysuckle we shall see the pins and threads standing far out from the mouth of the trumpet. There are six of these to each trumpet, and one is different from the others. Five are shaped like hammers with very long handles; the sixth is without the hammer-head, and ends in a little sticky knob like the head of a pin. If we pull the flower to pieces carefully, splitting the trumpet down the middle, so that we can see the bottom of it, we shall find that this long pin ends in a rounded green knob below the thin end of the trumpet. Inside this knob are many little white specks. The knob and the thread together are called the *pistil*.



These are the parts of simple flowers, such as the snowdrop. The snowdrop's bud hangs down and the white part splits into three sepals. The sepals spread out their tips and show us three petals inside. In the centre is a sort of pin called the pistil, with the seeds packed in the knob of the stalk, and around the pistil are six slender stamens, shown here attached and also loose, inside and out.

The five hammer-heads are *stamens*. They split open and give out a mealy, yellow powder called *pollen*. If a grain of pollen is placed on the sticky end of the pistil, the pollen sends out a shoot which pierces the pistil and finds its way right down to a little white speck in the knob, and pierces that also. Then a strange thing happens. The white speck begins to grow, the knob grows larger, and the trumpet drops off. The green knob becomes a juicy red berry and the white specks become seeds. But unless the pollen gets on the tip of the pistil there will be no seed.

In most of the brightly colored flowers the stamens and the pistil ripen on different days, or else the stamens are so placed that the pollen cannot fall on the pistil of the same flower. That is because these flowers cannot grow seeds from their own pollen. The insects fly to these bright flowers, and as they fly they pick up pollen on their hairy bodies and rub against the sticky pistils, leaving a little behind.

THE NEXT STORY OF PLANT LIFE IS ON 3889.

WHAT THIS STORY TELLS US

IF we make a careful examination of the brain, and especially of the new brain, we find that it is truly a double organ. It is easy to prove, in other ways, that the two sides of the brain differ very much in their duties and their importance; but actual examination of the brain itself does not show us the differences that we might expect. Though the brain has everything to do with the question of right-handedness and left-handedness, no one could tell whether a man was right-handed or left-handed by examining his brain. It is important to set this out clearly at first, lest we should think that one side of the brain is in some way inferior to the other. This is not so. One proof of this is to be found in the fact that either side of the brain can be educated for special purposes; and if one side fails, the other will do just as well, provided that we call upon it during our early years, when almost all things are possible.

THE PARTS OF THE BRAIN

CONTINUED FROM 3692

THE great majority of people are right-handed; only a few are left-handed. No one is perfectly equal-handed in everything he does. Many people have to be both-handed in certain respects. The violinist, for instance, has to train one hand for one kind of work, and the other for another, both equally difficult, though different. The pianist has to train both hands to do exactly the same work. Now, people who know nothing of this subject think sometimes that there is some natural difference between the two hands, or the two arms, or, as in the case of a footballer or an organist, between the two feet. That is a mistaken idea; the whole question is a question of brain, and we have already seen that there are no natural differences between the two sides of the brain, so far as we have been able to discover.

The first thing for us to do is to trace the connection between the brain and, say, the arm, and at once we find a very remarkable thing, which no one would have expected. If we begin at the great centre—in, for example, the left side of the brain—which controls all our intentional movements, we find that a large number of fibres from the nerve-cells in it are gathered together to form a bundle, which is, of course, the great path of the will. This bundle runs down through the brain—on the left side, of course—but gradually approaches the middle line of the body, and then, at a certain point, practically the whole of it crosses over to the right side. This happens in the part of the brain called the bulb. The consequence of it is that the left side of the brain is the master of the right side of the body. Exactly the same is true in respect of the right side of the brain and the left side of the body.

When we call a person right-handed, then, we really mean that he is left-brained, and that a left-handed person is right-brained. In either case we must describe the brain as having a leading or more important half, and in a short time we shall come to see that when a person is left-brained, this affects not only the use of the right hand, but many other functions of the body.

Now, we have already learned that the two sides of the brain at birth are exactly the same, so far as anyone can make out, and even in later years no one can find any difference between them. Why, then, do people become left-handed or right-handed? Why are there so few left-handed to so many right-handed people? And, if the two sides of the brain are naturally the same, why are we not all both-handed? It is best to begin answering these questions by settling

the last point first. The reason why we are not both-handed is a matter of economy. Life does not like waste. If one thing will do her purpose, Nature does not employ two. When the education of the brain starts, if one side of the brain has the advantage, Nature favours that side. Nature is like a schoolmaster with two boys in his class, one of whom gets a slight start, while the schoolmaster neglects the other altogether.

WHY ONLY ONE SIDE OF THE BRAIN NEEDS TO BE EDUCATED

There is no need for both sides of the brain to be equally educated. One side gets an early advantage, and then the more it has, the more is given to it. But it must never be forgotten—though it usually is forgotten—that the less-educated side of the brain is naturally just as good, and has quite equal possibilities of being the leading half; so that there is always this other half of the brain to fall back upon. We must see how this works out.

A man of seventy may meet with some kind of accident or injury, visible or invisible, which prevents the working of the leading half of his brain—the left half, if he is a right-handed man. There is still the right half of his brain available for the same kind of work. With labour and patience, he may be able to teach the right half of his brain to do very imperfectly one or two things which the left half of his brain used to do. But I fear that in cases like this the poor man is almost as badly off as if he had nothing to fall back upon. The reason for this is that when people get old the brain's power of learning becomes less. During youth is the best time to learn. Now let us take the case of a little child of five or thereabouts: he can talk, and perhaps even read a little; he can draw, and even make a few simple letters with his right hand.

HOW THE BRAIN REPAIRS AN ACCIDENT TO ITSELF

Some accident may affect the working of the child's brain, just as in the case of the old man; but the difference between the two cases is tremendous. The right half of the little boy's brain now simply takes the lead. It is true that, as we shall learn, he has to begin again by saying "Papa" and "Mamma," just like a tiny baby; but yet, because his brain is young and still developing, a child like this will, in a year or two, be practically as well off as if the accident had never happened at all. Such cases are not very common, but they are quite well known.

But we have still set ourselves some questions which must be dealt with. We have already decided why people do not become both-handed, unless, like the pianist, they have some special reasons for setting both sides of the brain to learn the same lesson. But we still have to find out why there are about ten or more right-handed people to one who is left-handed, and the puzzle is greater because, as we have seen, there is nothing to be found in the brain itself to explain this difference.

Well, in the first place, it is certain that custom, tradition, and prejudice have something to do with the difference between the numbers of right-handed and left-handed persons. It is probable that a very considerable number of children, at any rate, are born with no natural bias in favor of either hand.

RIGHT-HANDED PEOPLE AND LEFT-HANDED PEOPLE

It is interesting to make observations on babies in this respect. Often it is impossible to make out that they prefer the use of one hand to that of another, but when we begin to teach them things, we usually favor the right hand; in other words, it is the left half of the brain that gets all the practice and education, and so it gets the lead. We notice this in games as in everything else.

In England it has been noticed that many cricket-players from poor families throw, bowl, and catch with the left hand, but they bat right-handed. Many of these were, I believe, naturally left-handed. They preferred to throw with the left hand long before they started cricket; but when they began to learn to use a bat, they were told to stand in a right-handed position. In cricketers drawn from wealthier families, it is very seldom that left-handed players are found, and especially left-handed batsmen. The reason is that as boys they were specially looked after from the first, and even those who would naturally have become left-handed have been made right-handed. When we notice things like this, we can understand that a great many of the estimates which are made as to right-handedness and

left-handedness are mere nonsense, because those who make the estimates forget the whole question of education. Some well-known authorities, for instance, have said that there is some relation between crime and left-handedness. The real truth is, however, that there is a connection between crime and lack of education, and there is more left-handedness among uneducated people, because there are fewer parents and teachers to be particular as to which hand the child uses. There is absolutely no connection whatever between right-handedness or left-handedness and any of the higher qualities of mind and character.

But, even when we allow for education, it seems quite certain that there is a commoner natural bias towards right-handedness than towards left-handedness, and this requires explaining. One kind of explanation is that the tendency is inherited, and this is interesting as far as it goes, but, of course, it does not tell us how the tendency began.

WHY SOME BABIES ARE BORN RIGHT-HANDED AND OTHERS LEFT-HANDED

It seems quite certain that, even apart from imitation and education, right-handed parents tend to have right-handed children, and left-handed parents to have left-handed children. Of course, in making studies like this, it is all-important, and also very difficult, to be sure that we allow for the consequences of education and imitation. But, with care and trouble, it is possible to do so, and then it becomes clear that heredity works in this way.

We already know that the question of the supply of blood is, perhaps, the most important of all questions for any living tissue; we know that it is, above all, important for nerve-cells. It requires only two or three seconds' interruption of the flow of blood for nerve-cells to stop working, as we see when a person faints. Thus it would be very interesting if we could find any difference in the blood-supply of the two sides of the brain; and some people have supposed that perhaps the left side, as a rule, gets a more rapid and fuller supply of blood than the right. If we examine the blood-vessels of the chest, from which run the arteries to the head, we find a certain amount of evidence in favor of this view. The arteries are so arranged that the blood-supply to the left side of the head seems to be a little more direct than to the right side. But when we examine the brain itself, it is impossible to find that either side is better favored with blood than the other, and it is not thought that this question, about which a great deal has been written and argued, is of very much importance.

SOMETHING ABOUT THE BRAIN THAT NO MAN UNDERSTANDS

The truth is that, after all these years of study, and though a whole library of books has been written on the subject, we still do not really know why more people should be left-brained than right-brained, except in so far as we know that the bias of education is partly responsible.

This question would be far less important if the difference between the leading half and the led half of the brain were only a matter of the comparative skill between the two hands, and that, of course, is what most people think. But, really, that is far and away the least part of the whole matter. Within the last twenty or thirty years we have learned that the right-handed—that is to say, the left-brained—person is not only more skilful with the left side of his brain in the use of his hands, but he speaks and writes with the left side of his brain; he reads with it; he follows music with it; and left-handed people do all these things with the right side of their brains.

Let us begin with the case of hearing. Everything goes to prove that, so far as the mere hearing of sounds is concerned, the two sides of the brain are quite equal in every healthy person; but there are certain kinds of sounds which we call language, and they introduce another need. It is not sufficient to hear; we must also understand, for we may hear someone speaking in a language without understanding it.

THE SPECIAL PART OF THE BRAIN THAT UNDERSTANDS WORDS

It has been proved that in right-handed people the understanding of words is entirely done by the left side of the brain. A special part of the brain there has been taught to perform the duty of understanding words. It is called the word-hearing centre. If it is thrown out of action by anything, the person will hear perfectly, but only as a child hears, or as we hear an unknown

language. There is good evidence to show that, where people know more languages than one, the understanding of them is not all mixed up in one particular part of the brain, but that they have their own little centres, developed by education, situated near or on the outskirts of the ordinary hearing centre in the leading half of the brain, whether that happens to be the right or the left.

WHY WE SOMETIMES HEAR WORDS WITHOUT UNDERSTANDING THEM

We have all noticed that sometimes, when we are not attending to the talk of those around us, we hear that something has been said, but do not understand it, and so perhaps we say: "I beg your pardon"; and before our friend has time to repeat what he said, we have understood it. The words were recorded and heard in the hearing part of the brain, but the reason why we did not "take in" what was said was that the sounds had not been *taken* from that part to the word-hearing centre, where alone they could be interpreted. A second later, when we attended, that happened. A case like this helps us to understand not only the working of the brain, but also what is meant by attention.

In the case of music, too, it is one thing merely to hear, and another to understand. In this case, also, it seems that there is a special centre developed in connection with, and close to, the hearing centre in the leading half of the brain. The brains of some well-known composers have been examined after their death, and it seems clear that some of them have a specially rich development of the cells in this part of the brain.

THE MANY LESSONS WE COULD LEARN BY EXAMINING A GREAT MAN'S BRAIN

It is worth while to note, in passing, that a valuable service is rendered to future generations when a great man, whose brain has already been invaluable to humanity, gives orders that, when he dies, his brain may be examined, so as to add to our knowledge of this most wonderful of all wonderful things. In point of fact, we are only just at the earliest beginnings of our knowledge of the brain and its working. We know a little of the brain in general, but we have practically everything yet to learn as to the all-important and endless differences between one brain and another. At present the study has almost entirely to be made upon brains of persons who were not at all noteworthy, but our biggest need is to study the brains of great and unusual people.

It is known that not a few of the wisest of living men have given orders that, after their death, their brains are to be examined for the advancement of knowledge. We have yet to learn all about the brains of people of great general ability—people who are very clever with figures, artistic people, musical people, clever writers, great thinkers, and so on. There is an extremely interesting theory about the finest kinds of brain, which we shall learn in a little while.

Now let us turn to the case of seeing. We are certain that things are seen perfectly on both sides of the brain, but we know that in right-handed people, for instance, it is only in the left half of the brain that reading is accomplished. If the word-seeing centre is thrown out of order, the person will see as well as ever he did in his life; he could make perfect copies on a piece of paper of the letters he has in front of him; but they mean no more to him than to a baby.

A SENSE THAT IS GREATER IN MAN THAN IN ANY OTHER CREATURE

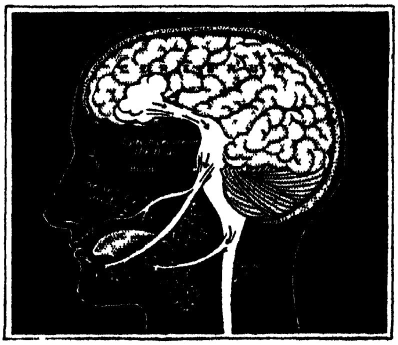
It is also probable—though we do not yet know this for certain—that, just as is true in the case of music, the higher kinds of seeing are done in the leading half of the brain. It may be that the kind of seeing done by the artist is done by the leading half of the brain. According to some students, it may even be that we also appreciate color in the leading half of the brain.

This is a subject about which we have yet a great deal to learn. It is possible, however, to find out, in a given brain, very precisely what are the exact limits of the seeing area, which, as we know, is at the very back part of the new brain. Now, we find that this seeing area has been growing, so to speak, for ages past in the main line of progress of animal life, and that it is much larger in man than in any other creature; it also varies very largely in different human beings. In the brains of many idiots, and also in the brains of some of the lowest savages, we find very notably that the vision area is small compared

with what we find in the brains of healthy individuals of the higher and more intellectual races of mankind.

Now, the hearing and seeing of words come first in order, so to speak, because we must receive before we can give; and after that we ought to study the way in which we speak and write. Of all these various centres, it is, of course, the word-hearing centre that first develops in a child, and after that the speaking centre. These really form a pair. In persons who have been taught to read and write, another pair is developed—the reading or word-seeing centre and the writing centre. Let us now study the speech centre.

We have only to think for a moment to realize that in some ways the speech centre must be the most wonderful and important part of the human brain. Of course, reading and writing are enormously important, but then they are really only a newer kind of speech, after all. Now, it is speech, or language, that is one of *the* great marks of mankind. In many ways we are human just because we can speak, and so we may say that the speech centre in our brains marks the beginning of what really has made, and makes, us human, and far more wonderful than any other living creature that is known.



This diagram shows the speech centre of the brain, known as Broca's area because it was discovered by a Frenchman named Broca. The same part of the brain controls the muscles of the lips, tongue, and jaws. The arrows show the direction in which the nerves convey the impulse to the muscles.

Of all the special centres in the human brain, this was the first to be discovered, which is very appropriate, as it must have been the first to be developed. It was discovered by a celebrated Frenchman named Broca, about the middle of the nineteenth century, and is known as Broca's area. In the picture on this page, showing the left side of the brain of a right-handed person, we see the speech centre. If we examine the brain from another point of view, and note, in the area for motion, the various points that control the different muscles of the body, then we find that the speech centre lies in the same part of the brain as that which controls the muscles of the lips, tongue, and jaws. But it would be a great error to suppose that that is all the speech centre does. The muscles which we use in speaking are all represented on both sides of the brain; but it is one thing to be able to move them, and another to be able to speak with them. If anything happens to throw the true speech centre out of action, the person can still use all his muscles.

If we say a word, he can say it after us; but he can no more speak, in the real sense of speaking, than an animal can. He may imitate like a parrot, but that is all. The only exception to this is that, in many cases, just a few words, like yes and no, are still kept, and the reason seems to be that they have been so often used that they have found a home in the other side of the brain also It has been discovered, also, that rough persons who use bad language are still able to use an oath or two when all the rest of their power of speech is gone. They have used these words so very many times that they seem to have become firmly fixed in both sides of the brain. Though the speech centre has been known for many years now, and though the study of illness and accident has taught us a good deal about it from the point of view of disease, we still have almost everything to learn about it from the point of view of health. Everyone knows that different races and different individuals vary very much in their power of speech. Everyone knows, too, that some of the wisest and most thoughtful of men speak slowly and with hesitation, and with many mistakes, even in private conversation, while they can speak in public scarcely at all. On the other hand, men who are neither wise nor thoughtful often hold a large audience spellbound for an hour. But sometimes a wise man may also be a good speaker. These facts express a truth which applies generally to the whole of the brain and its uses. It is that different parts of the brain vary independently of each other. One man may have a splendid speech area, and

the rest of his brain may be commonplace; or it may be the other way round. We have all heard what was said of the poet, Oliver Goldsmith: "Who wrote like an angel, and talked like poor Poll."

One of the few really great poets of the last half century, who wrote many poems which will be read as long as English is read, was a most stupid and hesitating and commonplace talker. This proves that the speech area of the brain, like other areas of the brain, is an extremely independent thing.

THE POWER TO TALK, WHICH CAN MAKE FOR GOOD OR FOR EVIL

This has a very great importance for any nation that is governed as we are governed. Many people think that all that is necessary to prove a man a good law-maker is the power to speak well on any subject. Now, everyone who votes for members of our Congress ought to know that the mere power to talk, though it is a very notable thing, and may be a very useful thing, and has often altered the history of nations for good, has yet often altered their history for evil, and so helped to destroy them.

The wise, strong, priceless man may be silent; it is even possible that he may be so busy thinking that he has not time to speak! Wise people who look around them know all these facts; but the interesting thing is that our modern knowledge of the brain, and especially what we are learning as to the independence of the different parts of the brain, and the way in which they vary in different people, independently of each other, all teach us the same lesson. It will be a very good thing when all of us who have a share in deciding who shall govern us use our educated judgment in this very important matter.

THE DIFFERENCE BETWEEN FINE BRAINS AND COMMON ONES

And now we may consider a theory which probably helps us to explain in some degree the difference between fine brains and common ones. There would certainly be a great difference between a pianist who always practised with one hand only, and always with the same hand, and another pianist who practised with both hands. If the two sat down one after the other to play a great piece of music, everyone would know the difference. Again, it can be proved that it makes a great difference to people whether they use only one eye in looking about them, or whether they use two. In the case of those people who do not see straight, or in people whose eyes are very unequal, which is more common, we find that the constant use of one eye only greatly deprives them of the power of judging distances, of seeing perspective, and of realising the depth and solidity of things.

Anyone who has ever looked through a stereoscope knows what a tremendous difference it makes to look at an ordinary photograph, and then to look at a stereoscopic view, using both eyes. When we use both eyes, that is a case of what is called binocular vision. A very wise man, called Dr. John Brown, who wrote "Rab and His Friends," suggested many years ago that some people seem to differ from others as if their thinking were, so to speak, binocular, and so they had the gift of seeing the perspective and depth of things. This is a rather good idea. Herbert Spencer, also, had the same idea as Dr. Brown; but, as he was a great student of the mind and the brain, he was able to develop the idea.

GREAT THINKERS, WHO USE BOTH SIDES OF THE BRAIN

He suggested that in good thinkers the two sides of the brain were probably used together much more than in ordinary people. When we look at the huge bundle of fibres that run across from one side of the brain to the other, we can see the force of this. Some day it may be proved that Herbert Spencer's theory is true, not only of thinking, but also of understanding and creating poetry and music, beautiful pictures, and so forth. One of the deeply interesting questions yet to be decided, probably by the present generation, is how far and in what ways, by our education of the young, we can develop to the utmost both sides of the brain, without waste of power and without lowering the quality of the education of both sides. This last is a most important point. There is nothing gained if we educate both sides of the brain to a lower standard than we could reach if we worked on one side. We must be content to let one half of the brain lead and the other be led.

THE NEXT PART OF THIS IS ON PAGE 3913.

THE MAN WHO CARRIED DEATH

CONTINUED FROM 3740

FORTUNATELY, the days have passed away when the majority of people thought of war as something grand and glorious. Even those who believe that war is sometimes necessary are agreed that, whatever may be the cause that leads to fighting and bloodshed between nations, war is undoubtedly one of the greatest evils that can happen to any people. And yet the annals of war tell of many great and heroic deeds—deeds not merely of fierce daring in the destruction of the enemy, but of courage and endurance in the saving of life.

During the Crimean War a gallant deed of this kind was performed by Captain William Peel, the commander of one of the British warships, whose men had landed to take part in the fighting on shore. Captain Peel and his men were sent to a certain place where the guns were keeping up a constant fire upon the enemy's position. Suddenly the ammunition was found to have given out, but a number of men at once volunteered to go and bring the ammunition to the battery, although to do so was to run into the greatest danger, as Russian shells were falling and bursting all round. At last the boxes of powder and shot were brought to the battery, and the men were hastily unpacking them, when right into their midst dropped a large shell from the Russian lines. The fuse was burning, and in a moment or two the whole battery must have been blown to pieces. The men stopped in their work, and looked at the shell as though fascinated, expecting every second that the shell would burst and destroy them.

But Captain Peel was a man of action and of great presence of mind. Without a moment's hesitation, or a thought of his own safety, he rushed across the battery, seized the shell, and ran with it to the side of the battery.

The other men found their voices in a moment, and shouted : " The fuse is burning ! Look out, the shell will burst ! " But Captain Peel continued to run with the shell away from where the others were standing, and, raising it high above his head, hurled it over the earthworks that protected the guns.

Scarcely had the shell left his hands when it exploded with a terrific crash. A moment or two later and the brave captain would have sacrificed his own life in the effort to save his men, for when the shell fell into the battery Captain Peel could easily have escaped; but his courage, energy, and presence of mind saved the whole of the band of men who were unloading the ammunition and serving the guns.

For this gallant deed Captain Peel was awarded the coveted Victoria Cross.

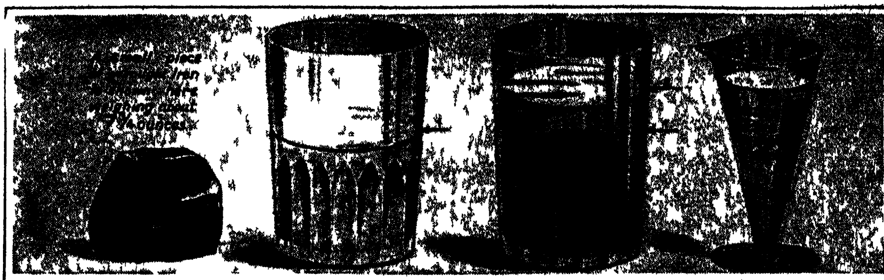
THE PICTURE OF A GOLDEN DEED

A YOUNG Scotch minister went one day to visit the birthplace of Thomas Chalmers in an ancient and obscure town on the Firth of Forth. When he had examined this house, he and his companion entered an inn for refreshment. The room into which he was shown had its walls covered by absurd pictures, such as shepherdesses with crooks and sailors home for the holidays. But over the mantelpiece was a picture of quite another kind making a very strange contrast with the rest. This picture represented the gloomy interior of a cobbler's shop. The cobbler was seated on his stool—an old man with spectacles pushed up over his brow, a shoe between his knees, and a hammer in his hand. The massive forehead and firm mouth suggested strength of character and an iron resolution. But under his bushy eyebrows two of the kindest eyes in all the world beamed with benevolence on a half-circle of ragged boys and girls grouped before the old man with lesson-books in their hands. The young Scotch minister read the inscription, which told how John Pounds, a cobbler in Portsmouth, took pity on the multitude of poor ragged children left by ministers and magistrates, and ladies and gentlemen, to go to ruin in the streets; how, like a good shepherd, he gathered in the wretched outcasts; how he taught them and trained them to God; and how, while earning his daily bread by the sweat of his brow, he had rescued from misery and saved to society not less than five hundred of these children. The young minister was the famous Dr. Guthrie, and this humble picture of John Pounds led him to become the apostle of the Ragged School movement. "I felt ashamed of myself," he related afterwards. "I well remember saying to my companion: 'That man is an honor to humanity, and deserves the tallest monument ever raised within the shores of Britain.' I took up that man's history, and I found it animated by the Spirit of Him who had compassion on the multitude." John Pounds was a clever man besides, and, like Paul, if he could not win a child any other way, he won him by art. He would be seen chasing a ragged boy along the quays, and compelling him to come to school, not by the power of a policeman, but by the power of a hot potato. Often on a cold winter morning he used this bait to draw a child to his little workshop, which was also his schoolroom. He loved children, and knew what a treat a baked potato was to a hungry child. When the day comes when honor will be given to whom honor is due, we can fancy the crowd of those whose fame poets have sung, and to whose memory monuments have been raised, dividing like the wave, and, passing the great and the noble and the mighty of the land, this poor obscure old man stepping forward and receiving the especial notice of Him who said: "Inasmuch as ye have done it unto one of the least of these my brethren, ye have done it unto Me." This is an example of the great influence of a picture. In seizing Dr. Guthrie's imagination, this picture became a great influence in the lives of many thousands.


JOHN POUNDS, OF PORTSMOUTH


THE PICTURE THAT HELPED DR. GUTHRIE
From the painting in the possession of Sir John Kirk.

THE NEXT GOLDEN DEEDS ARE ON PAGE 4025.



When a piece of iron is placed in a glass of water it displaces its own bulk of water, and the liquid rises from 1 to 2 as in the second glass If the displaced water and the iron be weighed, it will be found that the iron is about 7¾ times as heavy as the water, and so its specific gravity is 7¾

THE SIZE & WEIGHT OF THINGS

CONTINUED FROM 3676

WE read about the way in which things are measured—about the measurement of time, temperature, mass, and so forth, on page 3671 We may also learn to distinguish between weight and mass, and we may learn something about the balance of forces. We must now learn a little more about gravity, and then about another very interesting thing which is called specific gravity

In the case of gravitation, we can allow things to drop, and measure their rate of falling, as we read on page 3674 It is very difficult, however, to get accurate results by this method Far more precise results can be obtained by the use of a pendulum, for the rate at which a given pendulum swings depends upon gravity; and when we try this method we find that one and the same pendulum will swing at different rates in different parts of the world

This can only mean that the force of gravity is not the same in different parts of the world. We know that the earth is flattened at the North Pole and the South Pole This means that anything at the Equator is farther away—several miles farther away—from the centre of the earth than it would be if it were taken to either the North or the South Pole As the force of gravity varies with distance, a thing must therefore be heavier at the Poles than at the Equator.

But there is another reason why this should be so. The earth is spinning all the time If we could stand upon either Pole of the earth, we should, of course, spin round once in twenty-four hours. If anything were placed six inches from the Pole it would, of course, describe a little circle round it in twenty-four hours This movement would be very slow indeed. But very different is the case of that same thing if we take it to the Equator.

At the Equator the circumference of the earth is about 25,000 miles, and just as the thing near the Pole has to travel a few inches in twenty-four hours, so at the Equator it has to travel 25,000 miles in twenty-four hours—more than a thousand miles an hour Now, we know that anything moving in this way on the surface of the earth—like the stone in the sling, as we see in the picture on page 3676—tends to fly out at a tangent to the circle in which it moves, and this is stupidly called "centrifugal force"

This, of course, applies to anything on a spinning body like the earth. The quicker the thing moves, the greater is its tendency to fly out; in other words, the so-called centrifugal force becomes greater and greater, the nearer anything approaches to the Equator, for the nearer it is

to the Equator the more quickly it is bound to move. This force acts against the earth's gravitation; indeed, it is the earth's gravitation that prevents things from flying out, and keeps them traveling in a circular path on the earth's surface, though the motion in them—like that of a stone in a sling—wants to make them fly out.

THE PULL OF THE EARTH, THAT GETS LESS AS WE APPROACH THE EQUATOR

Therefore, as the force acting against the earth's gravity increases as we approach the Equator, the force of gravity, when we weigh it, seems to be less the nearer we go to the Equator. It actually is less, because we are farther from the centre of the earth.

We know that gravity has the power of increasing by 32 feet in every second the rate at which anything falls to the earth. It is this rate by which we measure gravity, and now we can say more exactly what the figures are, and we can also learn the proper way in which to state them. We can take, for example, the first letter of the word gravitation, and we can let the letter g stand for the intensity of gravity in any part of the world. In England the value of g, we say, is about 32·2 feet per second; that is to say that for every second that anything falls in the British Isles its rate of falling is increased by about 32·2 feet each second; in other words, gravity produces, in England, during every second of its action, an acceleration—that is, a quickening—of 32·2 feet each second.

Now, the value of g at the Poles is about 32·25. We know that ·25 is a quarter, so that for every second during which a body falls at the Poles, gravity increases its speed by about 32 feet 3 inches; whereas in England the 3 inches would be nearer 2 inches. The value of g at the Equator is decidedly less than 32·1; so that the acceleration will be very little more than 32 feet 1 inch every second.

THE MEANING OF SPECIFIC GRAVITY, AND WHY IT IS IMPORTANT

We must now go on to study something else which depends upon gravity, and which is called *specific gravity*. The word specific, which is very much used in all the sciences, is really only another form of a word which we all know very well, and that is the word "special." We talk of the specific gravity of a thing, or of its specific heat, or the specific characters of a particular kind of animal or plant, and in all these cases the word practically means special.

When we talk of the specific gravity of anything, we are simply using a short expression for the amount of stuff in it in proportion to the space it occupies. A pound of lead takes up a great deal less room than a pound of wood; the lead has more stuff or matter in a given space. If we remember the word mass, we may say that the lead is more massive.

This question is very important, because of the great results which follow from the differences in the specific gravities of things. One thing floats and another sinks. When we run hot water into a bath of cold water, the hot water floats on the top of the cold; if we run cold water in after hot water, it runs as a stream at the bottom of the hot water; the warm breath from our lungs rises in the cooler air into which it is breathed; a balloon filled with hot air or hydrogen will float, or rise, and so on. All of these facts, and thousands more, depend upon the important question of specific gravity.

WHY WE USE WATER AS A STANDARD FOR MEASURING WEIGHTS OF THINGS

We are now faced again with the question of measurement. We want to be able, in some short and simple way, to say how heavy gold is compared with water, or how heavy water is compared with alcohol, and so on. That is the way we put it in ordinary speech. We say that one thing is heavier than another; we do not mean that a pound of gold is heavier than a pound of water, but that we can get a greater weight of gold than we can of water into a given space. Gold has a greater specific gravity. Water is such a common substance, and so important, that we may take it as our standard.

Ordinary water contains various things dissolved in it, especially gases, and these make a difference. So when we speak of water in this connection, we mean distilled water, but this is not all. We know that, as a rule, when things are heated they expand, and when they are cooled they shrink. The amount of stuff in a given space changes; in other words, the specific gravity changes. So it will not do to say distilled water. We must know at what temperature we

are considering it. When we study water, we find that it is densest, most shrunken, or heaviest, when it is 4 degrees centigrade above its freezing-point.

On the sensible centigrade scale, the freezing-point of water is nothing, so that 4 degrees centigrade indicates the temperature at which water is densest. Now, we can take this as our standard. The specific gravity of pure distilled water is 4 degrees centigrade, which we shall, for convenience, call 1; then, if we find anything that has twice this specific gravity, we shall call that 2, and so on.

We must choose all sorts of different things, and compare the weight of a given volume of each with the weight of an equal volume of water at 4 degrees centigrade. Here we are measuring weight, of course, and we are using it as an indication of the mass in the things we are examining. We are perfectly entitled to do this, because Newton has taught us that the weight of everything depends upon gravity, and that the force of gravity depends precisely upon mass. So if we compare the weight of things, we are really comparing their masses.

HOW WE MAY FIND OUT THE SPACE OCCUPIED BY ANYTHING SOLID

Now, suppose that we want to find out what is the specific gravity of some odd-shaped thing. We can weigh it all right, but we want to know more than what it weighs; we cannot tell its specific gravity until we know how much space it occupies, and if it is an odd-shaped thing, this may not be at all easy to find out. If it is a thing shaped like children's blocks, there is no difficulty. With a thing of irregular shape, we can easily find out how much space it occupies by putting it into water, and noticing how much the water rises.

It is often very important to study the specific gravity of liquids. For instance, milk ought to contain in itself a certain amount of solid matter melted in it. It is for this solid matter that we buy the milk, as it gives it its food value. If water is added to the milk, we are being cheated. And surely we are being cheated no less if the cow is made to drink large quantities of water, which really comes to the same thing. There must be some way in which we can tell whether the amount of solid matter dissolved in the milk comes up to the standard, and we can do this by measuring the specific gravity of the milk. In the case of spirits, we want to know how much alcohol they contain, and we can do this by ascertaining their specific gravity. These are two common instances, but, of course, very many others could be mentioned.

A LITTLE INSTRUMENT THAT TELLS THE SPECIFIC GRAVITY OF ANY LIQUID

There is a simple little instrument called the *hydrometer*, which means water-measurer, by which anyone can find out in a moment the specific gravity of a liquid. It is simply a glass tube with a weight at the lower end, and with a scale marked on it, like that on a thermometer.

The heavier the fluid in which we place the hydrometer, the less is the depth to which it will sink before it floats. On the tube is a mark which shows the level at which the hydrometer will float in water. If the liquid is lighter than water, as, for instance, alcohol, the hydrometer will sink deeper than this mark; if it is heavier than water, like milk, the hydrometer will not sink so far. We shall see in a little while what are some of the results that are obtained with this simple little instrument.

Another kind of instrument for measuring specific gravity is called a specific gravity bottle, and it is very simple and easy to understand. It can be used sometimes for measuring the specific gravity of liquids, and sometimes for solids. The bottle has to be very carefully made, so that it will hold exactly a thousand grains of water at the temperature we have agreed upon. The stopper of the bottle has a hole through which the contents can escape when the stopper is driven home.

A BOTTLE OF WATER, AND WHAT IT CAN TEACH US

Supposing we want to measure the specific gravity of some small shot, we can take a given weight of the shot and put it into such a bottle already filled with water. The volume of water that escapes from the bottle in order to make room for the shot is exactly the same as the volume of the shot inserted. All we have to do is to weigh the water that escapes and compare it with the weight of the shot. Suppose the shot weighs eleven times as much as the

water of the same volume, then the specific gravity of the shot would be eleven. This would be just about the figure if the shot were made of lead.

Or, again, we could fill such a bottle as this with ether, and then weigh the amount of ether that we could get into it. We should find the bottle that held a thousand grains of water would only hold about 715 grains of ether, so that the specific gravity of ether is ·715, if we call the specific gravity of water 1. It is often very convenient to use 1,000 for the specific gravity of water instead of 1, and then we can say that the specific gravity of ether is 715, that the specific gravity of milk is about 1,030—it should not be less—and that the specific gravity of healthy blood is 1,055, and so on.

DIFFERENT THINGS COMPARED AS TO THEIR BULK AND WEIGHT

Here is a table which shows us the specific gravities of some important substances as compared with the specific gravity of water, counted as 1. We shall readily understand that those things which possess a specific gravity higher than 1 will sink in water; while those, such as ice, for instance, which have a specific gravity less than 1 will float upon water; but the nearer the specific gravity is to that of water, the greater is the amount of the thing which must be immersed in water before it can float. Here is the list:

SOLIDS

Platinum (rolled)	22·1	Diamonds	3·5
Gold	19·3	Marble	2·8
Lead	11·4	Aluminium	2·7
Silver	10·5	Ice	0·9
Iron (wrought)	7·8	Potassium	0·9
„ (cast)	7·2	Lithium	0·6
Tin	7·3	Cork	0·2

LIQUIDS

Mercury	13·59	Sea-water	1·03
Sulphuric acid	1·84	Petroleum	0·84
Blood	1·05	Alcohol	0·79
Milk	1·03	Ether	0·71

Gases, of course, have their own specific gravity, just as solids and liquids have. In this case we usually take the gas hydrogen, which is the lightest of all, and we state the specific gravity of other gases by comparison with it. Sometimes air of a certain temperature is taken, but it is better to take hydrogen. If, now, we call the specific gravity of hydrogen 1, then that of oxygen is 16, and that of the mixture of gases we call the air is about 14·4; in other words, hydrogen is only about one-fourteenth part as heavy as air, though, of course, if we want to make this statement a precise one, it is necessary to state the exact composition of the air with which we compare it.

WHY A BALLOON GOES UP, BUT WILL NOT GO UP FOR EVER

We can now understand why a balloon filled with hydrogen will rise in the air; we can also understand that there will be a point beyond which it cannot rise, because the air becomes less dense as we pass upwards in it. In other words, the specific gravity of the air is lowered, and there comes a point when it can no longer do more than just sustain the balloon, even though the balloon is filled with hydrogen.

This is all we need say here about the specific gravity of gases, but we must note a few of the facts which are suggested in the table of solids and liquids. We notice the great weight of various metals, and also that one of them, though liquid, ranks high in specific gravity, even when compared with solids. This liquid metal is mercury. There is no other liquid which at all approaches it in specific gravity.

All the metals are by no means very heavy. Potassium and lithium, for instance—metals we seldom see in their pure state outside a laboratory—have a specific gravity of less than 1, which means that they will float upon water. Just above them in the table, we notice ice, and remind ourselves that water, when it is cooled to freezing-point from 4 degrees centigrade, expands, and therefore its specific gravity becomes less.

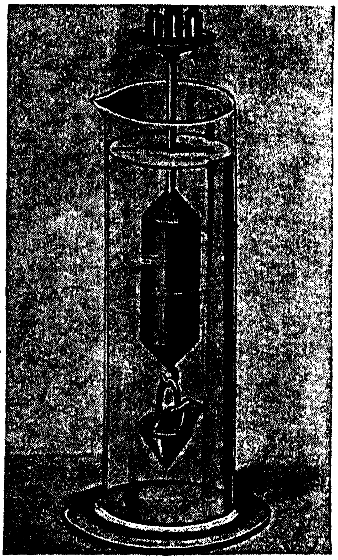
THE GREAT VALUE OF ALUMINIUM, THAT IS BOTH STRONG AND LIGHT

Perhaps, after the case of ice, the most important of the specific gravities noticed here is aluminium. This is also a metal, but very much lighter than any of the metals in ordinary use. We have only to compare it with iron, and remember that aluminium is a strong thing, to see that its extreme lightness must be of great practical importance.

There are some interesting points in the list of liquids. We have already referred to the case of mercury, and we note the astonishing difference between this liquid metal—the only metal liquid at ordinary temperatures—and all the

other liquids. Several of the specific gravities noticed in this list are of great importance in testing the purity and the composition of various things. In the official book that gives instructions to chemists, for instance, they are told that such things as ether or sulphuric acid, employed by them, must have such and such a specific gravity. The simple method of using a hydrometer provides us with an easier and quicker test of purity than any other.

When we compare milk with blood, we notice that milk, which is made by the body from blood, is slightly more watery. It is one of the most important duties of the body to keep the specific gravity of the blood at a constant level. None of the processes with which the blood is concerned can proceed properly unless its specific gravity is constant. If a person goes without water, fluid has to be drawn into his blood-vessels from the tissues around them, in order that the blood shall not become too dense. If, on the other hand, a person takes a great deal of water, this is not allowed to make his blood more watery than it ought to be, and all the resources of his body are immediately brought into action—not in a few hours, but in a minute or two—to get rid of the excess of water as quickly as possible. For this purpose, the lungs, the kidneys, and the skin are all available.



The hydrometer consists of a hollow cylinder (1) that floats in water, and is balanced upright by a heavy pan (2) in which is placed any object (3) whose specific gravity is to be measured. The object is first weighed out of water and then in water by putting weights on the platform (4) to make the upright stem sink to a standard mark (x). From these weights the specific gravity can be calculated.

If the individual to whom the excess of water is given is producing milk, then, in such a case, the glands that are producing the milk are pressed into the service of the body for the purpose of getting rid of the excess of water. In France there was not long ago an interesting prosecution of a cow-keeper who made his cows drink enormous quantities of water, thereby greatly increasing their output of milk, but, of course, greatly lowering its specific gravity and its food-value. It is for detecting such things that the hydrometer and the principle of specific gravity are so useful.

Of course, a very interesting question arises, whether we can accuse the man of watering his milk who puts the water into the cow instead of pouring it into the milk-pail. It is the business of the law to say that you shall not sell as milk anything which has less than a certain specific gravity. This has its difficulties, too. The specific gravity must not be made too high, for we must allow for the natural variations which neither the cow nor its owner can help; then, if we keep the specific gravity down, the dairyman will probably take good care to sell no milk of any higher specific gravity. When the cow produces a rich milk, he will water it down till it is still just within the requirements of the law. This shows that the making of perfect laws is a very difficult thing. Lastly, we must refer to the specific gravity of sea-water, which is just about the same as that of milk, but slightly less than that of the blood of the higher animals. This is interesting for two reasons. The history of living creatures teaches us that all life began in the sea. The correspondence between the fluids of our bodies and sea-water to-day is very interesting. It applies not only to their specific gravity, but also to the nature and proportion of the salts they both contain.

The other point about the specific gravity of sea-water is the manner in which it affects the art of swimming. Swimming and flying are both practical problems which depend upon specific gravity. The higher the specific gravity of the atmosphere, the easier it is to fly; the higher the specific gravity of water, the easier it is to swim.

THE NEXT PART OF THIS IS ON PAGE 3883.

DOWN AMONG THE WATER-BABIES.

There were two kind fairy sisters who looked after the water-babies. One was Mrs. Bedonebyasyoudid, and she was ugly and would remain ugly until people behaved well. The other was Mrs. Doasyouwouldbedoneby, and she was ever so pretty. She kissed and cuddled Tom at first, but once when she came she wouldn't pet him, as he had grown rough and was beginning to grow a prickly skin, the reason for which will soon appear.

THE STORIES OF CHARLES KINGSLEY

WE have read Kingsley's best-known novel, "Westward Ho!" and we are now to read a story of a very different kind, also written by him. "The Water-Babies" is a fairy story, and something more. It is an attempt to teach us a great deal about nature and human life and character in the form of a fanciful story. Fairy tales are not supposed to have "morals," and that is where Kingsley's story is different from other fairy tales; but here we are chiefly concerned with the story, which is an extremely pretty one. "The Water-Babies" was originally written to amuse and instruct one of the author's own children, a little boy, and it has entertained multitudes of children, old and young, since it was first printed.

THE WATER-BABIES

BEING A FAIRY TALE FOR A LAND-BABY

CONTINUED FROM 3719

ONCE upon a time there was a chimney-sweep, and his name was Tom. He was ten years old, and he lived in a great town in the North Country, where there were plenty of chimneys to sweep, and lots of money to earn for his drunken master. It was in the days when little boys were employed to go up the chimneys and clean them out. Little Tom had never been taught to read or write, and he was as ignorant and as dirty as a boy could possibly be. He never even washed himself. Altogether, he lived a very miserable and hopeless life in the dirty house of Mr. Grimes, the sweep.

One day Mr. Grimes was sent for by Sir John Harthover to come to his fine mansion, Harthover Place, and clean all the chimneys there. Mr. Grimes was so delighted at this fine job that he expressed his joy by knocking Tom down and drinking twice his usual quantity of beer that night.

They were up very early next morning, and Tom's master knocked him down again, just to remind him that he was expected to be an extra good boy that day. On the way to Harthover Place, Mr. Grimes riding on his donkey and poor Tom trudging behind with the brushes, they came upon an old Irishwoman, limping slowly along and carrying a heavy bundle. Although it was not yet five o'clock in the morning, she already seemed to be footsore and weary, so that even the heartless Grimes went so far as to offer her a lift beside him on his donkey. She declined this invitation, saying she would sooner walk with Tom. Grimes growled in reply that she might do as she pleased, and went on smoking.

As Tom and the Irishwoman went along, she asked him many questions about himself, and seemed very sad when he told her that he knew no prayers to say. She told him that she lived far away by the sea, and that although it rolled and roared on winter nights it lay still on the bright summer days, so that the children could bathe in it. Her stories of the sea were so wonderful to poor little Tom that a great longing to look upon it sprang up in him. He, too, would like to bathe and be clean.

When, at length, they came to a spring, near which the Irishwoman and Tom picked some flowers, Grimes got off his donkey, to refresh himself by dipping his head in the water. Because Tom followed his example, his master was displeased with him, and immediately thrashed him again.

"Are you not ashamed of yourself, Thomas Grimes?" said the Irishwoman, when he was belaboring Tom.

Grimes looked up, startled at her knowing his name; but his only answer was: "No; nor never was yet," and he went on beating Tom.

"True for you. If you ever had been ashamed of yourself, you would have gone into Vendale long ago."

"What do you know about Vendale?" shouted Grimes; but he left off beating Tom.

"I know about Vendale and about you, too. I know, for instance, what happened in Aldermire Copse by night, two years ago come Martinmas."

THE LAME IRISHWOMAN WHO MYSTERIOUSLY DISAPPEARED FROM SIGHT

At this, Grimes, who had been growing so angry that Tom was afraid he might strike the poor Irishwoman, was so cowed by her words—for she evidently knew something for which he could have been imprisoned—that he got on his donkey again without saying anything more. As they neared the great iron gates at the end of the splendid avenue that led to Harthover Place, the Irishwoman took her leave of Grimes and Tom, by disappearing before their eyes, after she had said:

"I have one more word for you both; for you both shall see me again, before all is over. Those that wish to be clean, clean they will be; and those that wish to be foul, foul they will be. Remember!"

After this we may suppose that Mr. Grimes was in none too good a temper when he arrived at the mansion, where nearly all the inmates, except a few of the servants, were still asleep. There were a great many chimneys to be swept, and due preparations had been made for this, the carpets of the rooms that needed attention being covered over with brown paper round the fireplaces.

Tom was sent up a good many chimneys and came down again safely. But at last he made a mistake, and, coming down the wrong chimney, found himself in a strange room. He had never seen the like before. He had never been in a room unless it were covered over with dust-cloths and paper, so that he stood bewildered in this prettiest of bedrooms, where everything was white. There were white window-curtains, white bed-curtains, white furniture, and white walls, and just a few lines of pink here and there. There was a washhand-stand, with ewers and basins, and soap and brushes and towels; and a large bath full of clean water. What a heap of things—all for washing!

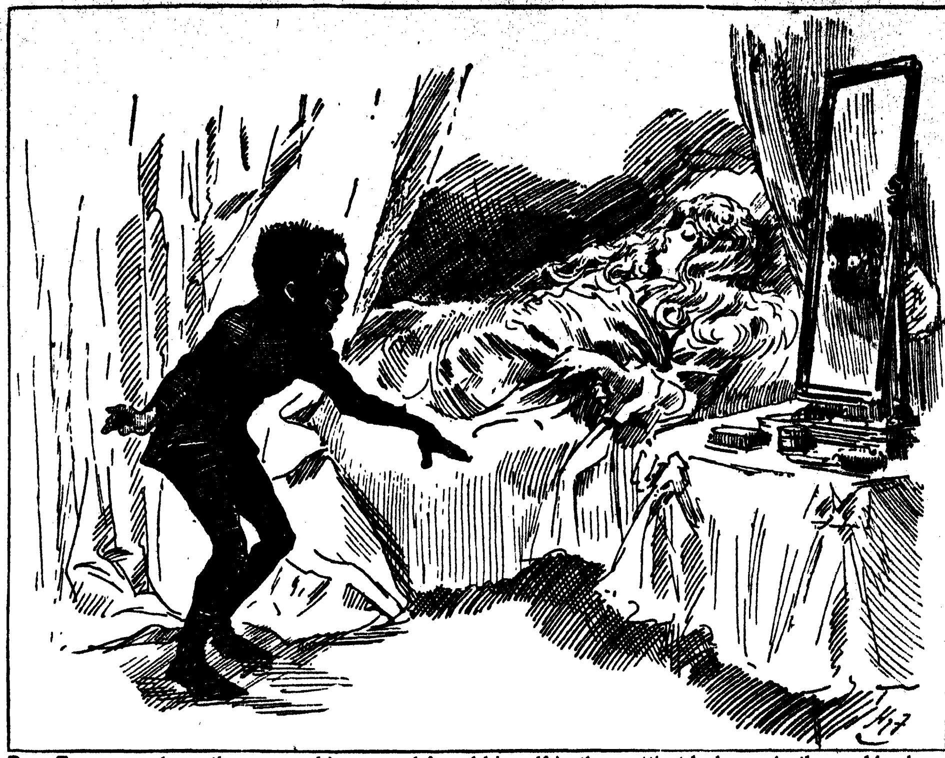
"She must be a very dirty lady," thought Tom, "to want as much scrubbing as all that. But she must be very cunning to put all the dirt out of the way so well afterwards, for I don't see a speck about the room, not even on the very towels."

Just then he happened to look towards the bed, and there lay the most beautiful little girl Tom had ever seen. He wondered whether all people were as white as she when they were washed. He felt certain that she could never have been very dirty at any time. Thinking of this, he tried to rub some of the soot from his own wrist, and thought, perhaps, he might look better himself some day if he were clean.

WHAT HAPPENED TO TOM IN THE PRETTY BEDROOM, AND WHY HE FLED

Suddenly, looking around, he saw standing close to him a little, ugly, black, ragged figure, with bleary eyes and grinning, white teeth. His first impulse was to drive this little black ape away from the clean room of the sweet

GRIMES, THE CHIMNEY-SWEEP, SETS OUT FOR HARTHOVER, WITH TOM TRUDGING BEHIND.



Poor Tom came down the wrong chimney and found himself in the prettiest bedroom in the world, where the loveliest little girl slept. He was horror-stricken and ashamed when he saw himself in a mirror and discovered how dirty he was. In hastening back to the chimney he made such a noise with the fender that the girl awoke and called her nurse, who came into the room; and thus began Tom's wonderful adventures.

little lady; but when he looked again, and found it was his own reflection in the mirror, he was so overwhelmed with shame that he hurriedly turned to the chimney again to make his escape.

In doing so, however, he upset the fender with such a clatter as to waken the little girl. On seeing Tom, she screamed loudly, and her nurse came running in, just in time to catch him by the jacket. But he was able to wrench himself away, and jumping from the window into a tree close by, he slid down to the ground and ran off across the park, while the nurse very stupidly continued to scream "Murder!" and "Fire!" at the open window.

Now began a most exciting chase. Surely there never was a dirty little boy pursued at once by so many different people. The under-gardener, the dairymaid, the groom, the steward, the ploughman, the keeper, Grimes, and even Sir John himself, all took part in the chase after Tom. The Irishwoman joined in it too, and, curiously enough, although she had seemed to be so lame on the highway earlier in the morning, she was now the only one that Tom could not shake off. Perhaps this was because he did not see her!

He had gained the high and open moor behind Harthover, and down in a narrow green valley he could see a cottage and a garden. His mind was so excited with all the events of the morning that he fancied he could climb down into the garden in five minutes. But the cottage was really a mile away, and a thousand feet below him. Little Tom, however, was brave enough to make the long and dangerous descent down the face of the hill, and all the time the Irishwoman, whom he did not see, was following him.

When, at length, he managed to reach the cottage, the door of which was all hung round with clematis and roses, he peeped in, half afraid. There, by the empty fireplace, which was filled with a pot of sweet herbs, sat the nicest old woman that ever was seen, in a red petticoat and short dimity bed-gown,

and a clean white cap, with a black silk handkerchief over it, tied under her chin. At her feet sat the grandfather of all the cats, and opposite her, on two benches, sat twelve or fourteen neat, rosy, chubby little children, learning their Criss-cross row, and gabble enough they made about it, to be sure.

TOM'S PLUNGE INTO THE RIVER, AND HOW HE BECAME A WATER-BABY

When Tom ventured to step into the cottage, his dirty little figure caused a great commotion among the chubby little children. At first the old woman would have turned him out, but when Tom pleaded that he was faint for lack of food and drink, her kind heart was touched, and, giving him some bread and milk, she took him to an outhouse where, on some soft hay, he could rest quite snugly. She promised to come to him an hour later, when school was over, and then left him.

Tom did not fall asleep at once, for he could hear the pleasant noise of the stream that ran close by, and, as he lay, half asleep and half awake, the thought that rose uppermost in his mind was: "How to be clean." People would never let him enter any decent place in his dirty state; he could never see inside a church—and he wished very much to see inside one—unless he were cleaned. "I must be cleaned, I must be cleaned," he kept saying aloud; and, half awake, he found himself out of the house and in the meadow, making for the stream, where, pulling off his ragged clothes, he plunged into the cool water.

Just before Tom had taken this cold plunge, the Irishwoman had stepped into the stream and changed into the most beautiful of fairies underneath the water. For she was, indeed, the Queen of the Water-Fairies, who were all waiting to receive her the moment she came back from the land-world.

WHY SHOULD THERE NOT BE WATER-BABIES AS WELL AS LAND-BABIES?

She told them that she was bringing a new brother to them, but, as he was still quite a little savage, and needed to be taught good conduct, he was not to see or know them for some time, though they were to watch over him and see that he came to no harm.

Meanwhile, of course, the chase after Tom had come to an end, although Sir John and his keepers made a second search the next day, as he felt sorry for the little sweep, and was afraid he might have fallen over some of the crags. The old dame at the cottage found he had vanished at the end of the hour, and, for a moment, was inclined to doubt the truth of his story; but when Sir John and the keepers arrived at her house, she knew that Tom had told the truth. They found the little fellow's rags by the side of the stream, and they also discovered his body in the water, and buried it over in Vendale churchyard, where the old dame used to go on Sunday to place flowers on the little grave. They were quite certain that Tom was dead.

But all the time Tom was swimming about in the stream, although he was now only about four inches long, with a set of external gills, just like those of an eft. The fairies had transformed him into a water-baby, and the body that had been found and buried was only the disused shell of him. There are land-babies, and why not water-babies? Some people tell us that water-babies are contrary to nature, but there are so many things in nature which we don't expect to find that there may just as well be water-babies as not.

TOM'S EARLIEST ADVENTURES AMONG THE CREATURES OF THE WATER-WORLD

Tom was extremely happy swimming about there in the river. He had even forgotten that he used to be so dirty. But he remembered how much he had been overworked in the land-world, and meant to make up for it by having nothing but holidays in the water-world for a long, long time to come.

He was still as mischievous as any land-baby, and made himself a perfect nuisance to the other creatures of the water, teasing them as they went about their work, until they were all afraid of him, and got out of his way, or crept into their shells; so that he had no one to speak to or to play with.

It was from a dragon-fly that he learned some valuable lessons in good conduct. For all his short sight, the dragon-fly had noticed a great many interesting things in nature, about which Tom knew nothing, and of which he heard with wonder. One day he might have been eaten by an otter, which was fully under the impression that Tom was only a common eft; but, behold, seven little terrier dogs rushed

at the otter, and drove her off, much to Tom's relief, though he did not guess that these were really water-fairies sent to protect him.

But before the otter had been headed off by the approach of the water-fairies, she had twitted Tom with being only an eft, and told him he would be eaten by the salmon when they came up from the sea—the great wide sea. Tom himself decided he would go down the stream, and discover what the great wide sea was like. On the way he met a great many salmon coming up, and warned them against the wicked old otter who had boasted to him that the otters were the lords of the salmon, and found them good to eat.

One night he saw men spearing the salmon, and some other men set upon them. There was a fight on the bank of the stream, and a man fell into a deep pool, and sank to the bottom, where he lay. Tom recognized him as his old master, Grimes. He expected him to turn into a water-baby, as he had done himself; but there he lay quite still at the bottom of the pool, and never went poaching salmon any more.

Every creature in the stream seemed to be hurrying down to the sea, and Tom, being the only water-baby among all the squirming eels and the scores of different things, big and little, we may guess that he had many strange adventures before he came to the sea. But great was his disappointment to find no water-babies there to play with, though he asked the sea-snails, and the hermit-crabs, and the sun-fish, and the bass, and the pollock, and the porpoises. But though one fish told him that he had been helped the previous night by the water-babies, Tom could find no trace of them at all.

We are to remember that, although he was a water-baby, he was also amphibious, which means that he could live on the land as well as in the water; so that at nights he took to playing about

THE FRIGHTFULLY WISE OLD PROFESSOR AND THE WATER-BABY

One day little Ellie was at the seashore with a frightfully wise old professor, who said there were no such things as water-babies. Just then he caught one, and it was Tom! But the professor wouldn't admit it was a water-baby, and when Tom escaped from him, Ellie tried to catch him, but slipped and injured herself.

among the rocks on the seashore, and there, one day, a funny thing happened to him. Lady Harthover, whose little daughter Tom had frightened the day he came down the wrong chimney, had come down to stay at the seaside with Ellie for a vacation. The little girl often went for walks along the shore with a very kind, good-natured, little, old gentleman, named Professor Ptthmllnsprcs, which is a very ancient and noble Polish name. He was professor of Necrobioneopalaeonthydrochthomanthropopithekology in the university which the King of the Cannibal Islands had founded, and had come to collect strange specimens from the seashore.

Little Ellie believed there were water-babies, but the frightfully wise old professor assured her that such ideas were all nonsense, although, after he had entered into long explanations which explained nothing, all he could say in reply to Ellie's question, "Why are there no water-babies ?" was "Because there ain't," which was neither very grammatical nor very polite.

HOW TOM WAS CAUGHT IN A NET, AND HOW HE ESCAPED AGAIN

Just as he said this, he was groping with his net among the seaweed, and caught Tom in the meshes.

"Dear me!" he cried. "What a large pink Holothurian; with hands, too! It must be connected with the Synapta." And he took him out.

"It actually has eyes!" he cried. "Why, it must be a Cephalopod! This is most extraordinary!"

"No, I ain't!" cried Tom, as loud as he could; for he did not like to be called bad names.

"It is a water-baby!" cried Ellie; and of course it was.

"Water-fiddlesticks, my dear!" said the professor; and he turned away sharply. But there was no denying it. It was a water-baby; and he had said, a moment ago, that there were none. What was he to do?

It was, in a way, fortunate for the professor that, when he poked Tom with his finger, the water-baby bit him so smartly that he was glad to drop him on to the seaweed, whence Tom dived into the water, and was gone in a moment. Little Ellie, in her desire to have the pretty little water-baby, tried to catch Tom before he disappeared into the sea, but, slipping on the rocks, she hurt herself so badly that she had to be carried away and taken home, where one night the fairies came along the moonbeams, bringing with them a pair of wings, with which beautiful little Ellie flew away in their company.

TOM HAS AN EXCITING TIME WITH HIS FRIEND THE LOBSTER

Now, when Tom had been picked up by the professor, he had recognized little Ellie, and wished so much that she could have been his playmate. But soon, as he was going along at the bottom of the sea, he came across a poor old lobster, with whom he had been friendly, caught in a lobster-pot. He tried to help him out, in doing which he nearly came to grief from the otter, who came along and accused him of having warned the salmon against her.

As it was, however, the otter got the worst of it in the fight that took place between the lobster and herself in the lobster-pot; and Tom was afraid his friend the lobster was going to be caught, when he saw the pot being pulled up. He escaped from it himself in time, and was delighted to see the lobster manage to snap away from it at the last moment, even at the cost of leaving one of his claws behind him, which, of course, was only a temporary inconvenience, as it would grow again.

And now a most wonderful thing happened to Tom, for he had not left the lobster five minutes before he came upon a water-baby. A real live water-baby, sitting on the white sand, very busy about a little point of rock. And when it saw Tom it looked up for a moment, and then exclaimed with delight: "Why, you are not one of us! You are a new baby! Oh, how delightful!"

TOM MEETS OTHER WATER-BABIES AT LAST

And it ran to Tom, and Tom ran to it, and they hugged and kissed each other for ever so long; they did not know why. But they did not want any introductions there under the water.

At last Tom said: "Oh, where have you been all this while? I have been looking for you so long, and I have been so lonely."

"We have been here for days and days. There are hundreds of us about the rocks. How was it that you did not

see us or hear us when we sang and romped about the rocks and sand every evening before we went home?"

Tom looked at the baby again, and then he said:

"Well, this is wonderful! I have seen things just like you again and again, but I thought you were shells or sea-creatures. I never took you for water-babies like myself."

Now, was not this very odd? So odd, indeed, that you will, no doubt, want to know how it happened, and why Tom could never find a water-baby till after he had got the lobster out of the pot. But if you will read this story nine times over, and then think for yourself, you will find out why. It is not good for little boys to be told everything and never to be forced to make use of their own wits.

"Now," said the baby, "come and help me, or I shall not have finished before my brothers and sisters come, and it is now time to go home."

"What shall I help you at?"

"At this poor, dear little rock. A great clumsy boulder came rolling by in the last storm, and knocked its head off and rubbed off all its flowers. And now I must plant it again with sea-weeds, and coraline, and anemones; and I will make it the prettiest little rock-garden on all the shore."

Tom grew prickly all over just because he did things for which his conscience pricked him, and he was sent to be taught by Ellie, the new water-baby, how he might become smooth again by giving up his bad habits and being kind to others.

So they worked away at the rock and planted it, and smoothed the sand down round it, and capital fun they had till the tide began to turn. And then Tom heard all the other babies coming, laughing and singing and shouting and romping; and the noise they made was just like the noise of a ripple. So he knew he had been hearing and seeing the water-babies all along, only he did not know them, because his eyes and ears were not opened.

And in they came, dozens and dozens of them, some bigger than Tom, and some smaller, all in the neatest little white bathing-dresses; and when they found that he was a new baby, they hugged him and kissed him and then put him in the middle and danced round him on the sand. And there was no one ever so happy as poor little Tom.

He gaily swam away with them to their home in the caves beneath St. Brandan's fairy isle; but he was still a naughty little water-baby, given to amusing himself by tormenting the anemones, the crabs, and other odd creatures of the sea, and paying no heed to the warning of the water-babies, who said: "Take care what you are at, as Mrs. Bedonebyasyoudid is coming back."

Early one Friday morning this tremendous lady indeed came, and when the water-babies saw her they all stood in a row, and smoothed down their bathing-dresses, and put their hands behind them, just as if they were going to be examined by an inspector.

Mrs. Bedonebyasyoudid was very ugly, and had a pair of large green spectacles on her great hooked nose. But she was very good to the water-babies, and gave them all some sea-sweets because their conduct had pleased her. Tom was very much disappointed when it came to his turn, as she popped a nasty, cold, hard pebble in his mouth, at which he began to whimper. So she reminded him that he had been cruel to the anemones by dropping pebbles into their mouths and making them think for a

moment that they had caught a good dinner.

"As you did to them, so I must do to you," said Mrs. Bedonebyasyoudid.

She also told him that it was quite useless for him to try to hide his actions from her, as she knew everything that the water-babies did, and could not help punishing those who did wrong.

WHAT TOM WAS TOLD BY MRS. BEDONEBYASYOUDID

She told him, too, that she was the ugliest fairy in the world, and would have to remain so until people behaved themselves properly, when she would grow as beautiful as her sister, Mrs. Doasyouwouldbedoneby.

"Now all of you run away, except Tom," she said; "and he may stay and see what I am going to do. It will be a very good warning for him to begin with before he goes to school."

Then she called up all the doctors who had given little children too much physic, and she made them take their own medicines, such as salts and senna, and brimstone and treacle, to say nothing of pulling out their teeth. Then she called up all the careless nurse-maids, and stuck pins into them all over, and wheeled them about in perambulators, with tight straps across their stomachs and their heads and arms hanging over the sides. After luncheon she punished all the cruel schoolmasters, and altogether she had a very exciting and exhausting day. All this had to be done every Friday, so we can see that her job was by no means an easy one. But people cannot always choose their own professions.

It was on Sunday that the ugly fairy's beautiful sister visited the water-babies, who were all delighted to see her.

HOW TOM WAS STRANGELY PUNISHED BY HIS OWN CONSCIENCE

To Tom in particular she was very kind, and petted him a great deal; but this did not make him a better water-baby, for he had now grown so fond of the sweet things Mrs. Bedonebyasyoudid kept in a secret store, that he searched out her hiding-place and ate as many as he could.

Of course the fairy knew what he had done, but she was more sorry than angry with the little fellow, and said nothing about it next time, giving him his share with the rest. She left it to his conscience to punish him, and that did its work, in a very curious way. When Sunday had come round again, and Mrs. Doasyouwouldbedoneby had come back, Tom was very anxious to be petted and cuddled by the beautiful fairy, but she said she could not do so, for, since her last visit, he had grown horny and prickly all over his body. And it was as she said. Just as his conscience had been pricking him on account of his wrong-doing, his body, too, had become as prickly as some of the sea-shells.

Tom could now see that the best thing to do was to confess to Mrs. Bedonebyasyoudid next Friday, and leave her to deal with him. This she did very gently, forgiving him for his naughtiness, and promising to send him a schoolmistress who would teach him how to get rid of his prickles. Who should this schoolmistress prove to be but little Ellie, who was now one of the most beautiful of the water-babies, and she came to know by-and-by that her little pupil had been the chimney-sweep who frightened her ever so long ago.

TOM'S WONDERFUL JOURNEY TO THE OTHER-END-OF-NOWHERE

For seven whole years they studied together, but as Ellie always went away on Sundays and Tom wondered where she was, he grew discontented, and said she was tired of him. He had more reason to be discontented when she disappeared altogether, and Mrs Bedonebyasyoudid told him it was she who had sent Ellie away. She also showed him "The History of the Doasyoulikes," people who had come away from the country of Hardwork, and what happened to them was certainly enough to frighten poor Tom.

In his new desire to win the good opinion of Mrs. Bedonebyasyoudid, he said he was ready to go to the world's end to find his old master, Mr. Grimes, who, the fairy said, was now at the Other-end-of-Nowhere. In order to get there he had first to go to Shiny Wall, and then through the White Gate that was never opened, on the way to Peacepool and Mother Carey's Haven, where the good whales go when they die. If he ever got there, Mother Carey was to tell him how he could reach the Other-end-of-Nowhere, and find Mr. Grimes. The journey was a very, very long

one indeed. All the way Tom fell in with adventures, but there was always somebody to help him with advice. There was the King of the Herrings, for instance, who showed him the way to the Allalonestone, where he was to find the last of the Gairfowl. In due course he came up to this queer old creature, who was rather like a penguin, sitting on her stone very mournfully. She told Tom her sad story, at the end of which she wept tears of pure oil, and confessed that her poor old brains were getting quite puzzled. She really did not know the way to Mother Carey's Haven at all. But a flock of petrels came winging along, and, when they heard what Tom was wanting, they said:

"Shiny Wall? Do you want Shiny Wall? Then come with us. We are Mother Carey's own chickens, and she sends us out over all the seas to show the good birds the way home.

Thanks to them, Tom soon reached Shiny Wall, which was really a big iceberg, under which he had to dive and swim for seven days and seven nights in order to come to Peacepool.

TOM FINDS MOTHER CAREY AND ALSO FINDS HIS MASTER UP A CHIMNEY

There, at last, in the middle of the pool, sat Mother Carey, like a gigantic marble statue, on a throne. And from the foot of the throne there swam away, out and out into the sea, millions of new-born creatures, of more shapes and colors than man ever dreamed, and they were Mother Carey's children, whom she makes out of the sea-water all day long.

Mother Carey gave him a pass which he was to keep until he got to the Other-end-of-Nowhere, the way to which she explained to him. It was only after many other strange adventures that he arrived there, and, showing his pass, was admitted into a curious kind of castle. Here he inquired for Mr. Grimes and was told he would find him up chimney No. 345 if he cared to go up on the roof and look for him.

Sure enough he found him there, with his head and shoulders just sticking out of the chimney, and in his mouth a pipe that would not draw. The sweep was grumbling very much, and when he saw Tom he supposed he had only come to laugh at him in his plight; but Tom declared he only wished to help him. Mrs. Bedonebyasyoudid now appeared on the scene, and reminded Grimes that he had often treated Tom as he was now being treated himself. Tom, however, urged her to let him help his old master, and vainly tried to wipe the soot from Grimes's face.

HOW TOM GOT HIS OLD MASTER RELEASED FROM THE CHIMNEY

Tom was so sincerely anxious to help him that his efforts at last softened the hard heart of the master-sweep, who now began to think of the mother he had forsaken in his youth, and he wept over his own wrong-doing. The tears that he shed increased at such a rate that they washed the soot from his face and clothes, and then they washed the mortar away from between the bricks, and the chimney crumbled down, and Grimes began to get out of it.

"Will you obey me if I give you a chance?" said Mrs. Bedonebyasyoudid.

"As you please, ma'am. For I'm beat, and that's the truth," said he.

"Be it so, then—you may come out. But remember, disobey me again, and into a worse place still you will go."

"I beg your pardon, ma'am, but I never disobeyed you that I know of. I never had the honor of setting eyes upon you till I came to these ugly quarters."

"Never saw me? Who said 'Those that will be foul, foul they will be'?"

Grimes looked up, and Tom looked up too, for the voice was that of the Irishwoman who met them the day they went out together to Harthover. She ordered Grimes to march off in the custody of a policeman, who was to see that he devoted himself to the considerable task of sweeping out the crater of Etna!

TOM RETURNS TO ST. BRANDAN'S ISLE AND MEETS ELLIE AGAIN

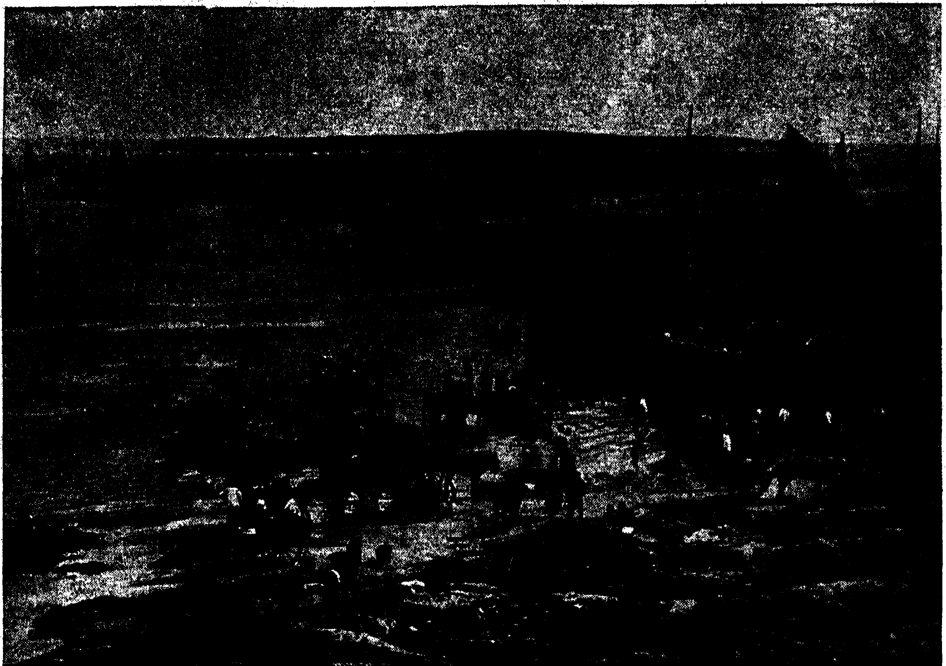
Tom now returned to St. Brandan's Isle, where he met Ellie, and they were ever so delighted to see each other again.

There Mrs. Bedonebyasyoudid came to them, and they tried to guess who she really was; but they did not succeed, and she told them they would know some day. Then, turning to Ellie, smiling, she said:

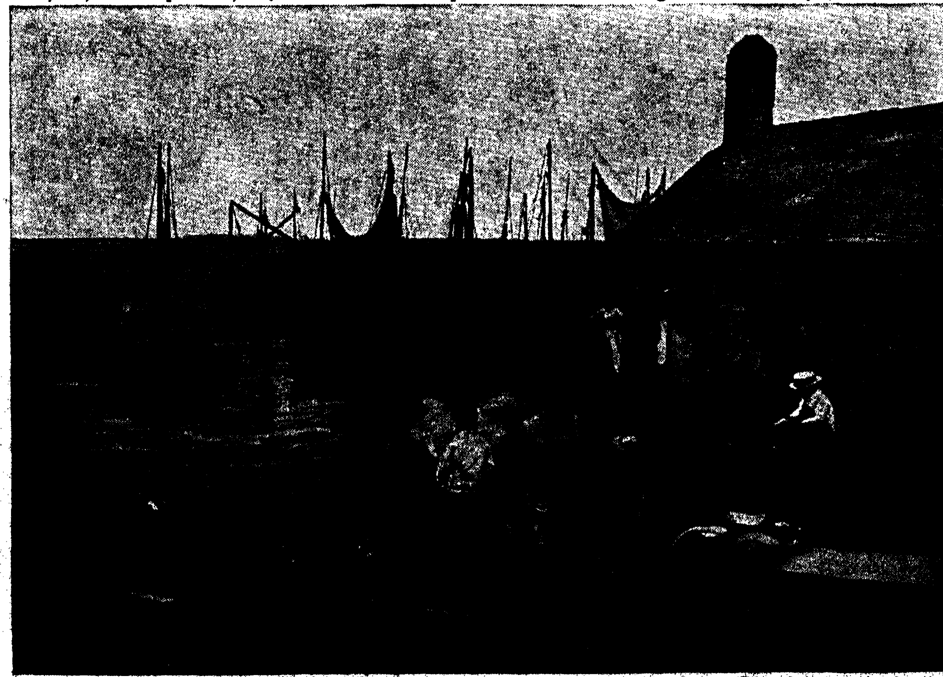
"You may take him home with you now on Sundays, Ellie. He has won his spurs in the great battle, and become fit to go with you, and be a man, because he has done the things he did not like."

THE NEXT FAMOUS BOOKS ARE ON PAGE 3969.

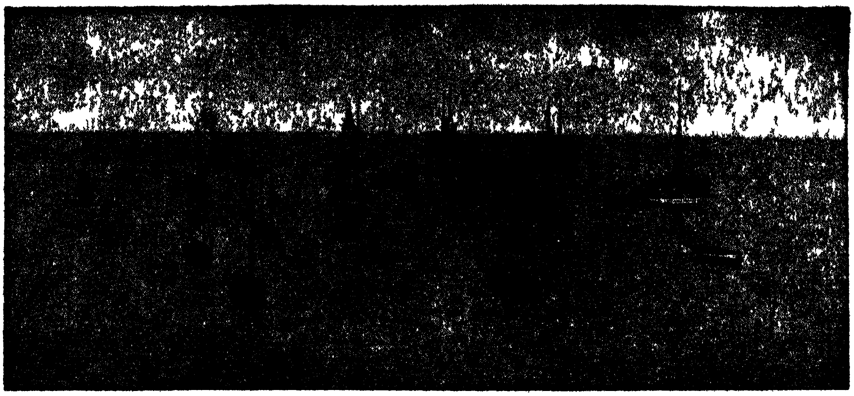
THE BOATS THAT CATCH THE FISH



Fishing is one of the important British industries, about 100,000 men being engaged in catching the fish at sea, while thousands more are occupied in preparing and selling them on land. The value of the fish landed in the United Kingdom in one year is about $50,000,000, while the weight of a year's catch is equal to 10,000,000 sheep and 1,000,000 cattle. In this picture we see fish being landed at Newlyn, in Cornwall.



Here we see fishing-boats at rest at Mousehole, a little village near Newlyn. The fish caught in the Cornish fisheries are chiefly mackerel and pilchards, and their value in a year is about $350,000. The fisherman's calling is toilsome and dangerous, and in ten years 2,500 men engaged in the British fisheries lost their lives, in one way or another. Four-fifths of the fish landed in England come from the North Sea.



HOW FISH AND OYSTERS ARE TAKEN

CONTINUED FROM 3764

THOUSANDS and thousands of men, and women, too, all over the world are engaged in getting food from the sea for themselves and others. Many thousands of men, women and children are employed in cleaning and preserving the fish. Thousands more work on shore making and repairing boats, nets and fishing tackle, or in preparing boxes and barrels into which the catch is placed. Thousands of boats, large and small, are employed in this operation, and the value of the food brought to shore is many millions of dollars.

From the earliest times men have eaten fish. All savages who live near the water eat fish, and some are very skilful fishermen. In Bible times there were many fishermen, who fished with nets and with hooks, but chiefly with nets. All through history we find stories of fishermen and their work. At the present time the world gets a great part of its food from the waters, both salt and fresh.

The fishing of Great Britain and Ireland are the most important, in proportion to the number of people. These islands are washed by the sea on every side, and some of the best fishing grounds in the world are in easy reach. The United States comes first in the value of fish caught, and the fisheries of Russia, Canada, France, Norway, the German Empire, and Japan are also important. Every country which has a seacoast will have fisheries as a matter of course.

DIFFERENT FISH IN DIFFERENT PARTS OF THE WORLD

The same kinds of fish do not live in every part of the sea. Some like cold water, which would kill others. Some fish like to go to the warmer waters in winter, but come toward the north in summer. Many fish found in the Atlantic, are not caught in the Pacific, and the converse is also true. Even the fish in different parts of the Atlantic are not alike.

Many fish found in European waters are never seen in American waters, and there are others which belong to America alone. Often the fishes called by the same name in Great Britain and the United States are not quite alike, though they may belong to the same family. Sometimes a fish can be transferred from one sea to another. The shad belongs to the Atlantic, but the United States Bureau of Fisheries has set free millions of young shad on the Pacific and that delicious fish seems to be well established there now. It enters the streams to lay its eggs as far north as Alaska.

ALL FISH HAVE NOT THE SAME HABITS OF LIFE

Some fish live near the surface; others swim far below. Some will bite at hooks, and are caught on lines; others must be taken in nets, some of which are more than a mile long. Then there are oysters, mussels, lobsters and crabs, which are not fish, of course, though they come from the water, and are sold at the fish-market. In other places in our book you may find much about the different fishes and many pictures of them.

The simplest method of catching fish, which one person can use is the hook and line, but it is very slow work, unless the fish are plentiful and very hungry. Men fish with hook and line for sport, but the men who catch fish for market generally use other methods. Men sometimes go out in a boat and throw out several lines, which they draw behind them as the boat moves through the water.

More often the fishing schooners which have gone after cod, fasten a long line to buoys. To this line are fastened hundreds of shorter lines, each with a hook on the end. This is called "setting a trawl." The cod swim along together in great numbers, and sometimes hundreds will be found securely caught when the men go out in a small boat to examine the trawl. They are taken off, and fresh bait is put on the hooks, unless the cod have gone away, and the skipper decides to try his luck elsewhere.

THE FISHERMAN MUST LEARN TO THINK LIKE A FISH

Sometimes the fish will be plentiful, and then, all at once, will vanish from that part of the ocean. Some masters of fishing schooners learn to guess what the fish will do. When the fish cease to bite they go to the place they think the fish will go. Probably the movements of the fish have something to do with their food supply, and this is influenced by currents, temperature and winds. In the story of "Captains Courageous," you learn something of life on one of these schooners.

New England is the great deep sea fishing section of the country, and Gloucester is the most famous fishing port, though Boston is the greatest market for fish. The sailing vessels are being replaced by steam vessels now, and the business is not so picturesque as it once was, but there are still many fishing schooners to be seen. There is a fine picture of a fishing schooner on page 5372.

THE DIFFERENT KINDS OF NETS WHICH ARE USED

More fish are caught in nets than by lines. There are many kinds of nets. The pound net is set in shallow water, not far from the shore. Poles are driven down into the bottom to form an enclosure, and a net, shaped like a huge bag with an opening in one side, is set inside. A long net is stretched from the shore to the opening in the net. Fish swimming along, come to this "leader," as it is called, and swim along hoping to get around it. Soon they find themselves in the pound, and are too stupid to get out. Pound is an old English word meaning an enclosure. The fishermen come out in small boats, pull up the net, and take out the fish.

NETS WHICH ARE OVER A MILE LONG

Other nets, called seines, are long lengths of net, with weights on one side and floats on the other. One end is often fastened near the shore, while a boat takes the other out and drops it into the sea. The weights stretch the net toward the bottom, while the floats keep the top from sinking. This makes a wall of net, sometimes more than a mile long. A net so heavy as this cannot be drawn in by a boat. Ropes are attached to the sea end, and are taken to shore and attached to a windlass. The net is now in the shape of a great semicircle, which is drawn to shore, bringing with it whatever fish were within the space over which the net passed. There are other seines which are taken out in boats.

The gill net, or drift net, is often set across a channel, or the entrance to a bay. It is like a seine, except that both ends are usually free. Fish try to get through the spaces in the net, and become entangled. When it has been out some time the fishermen go out and take up the net, a little at a time, take out the fish, and drop it back again to catch other foolish fish which try to get through spaces too small for them.

There are other kinds of nets used in various parts of the United States. The shad net is set in a river like the leader of a pound net. The shad trying to get up the river to lay their eggs are entangled in the net, and held fast. Fyke nets are great bags set at the bottom of

the sea. They have mouths shaped like a funnel, and the fish are not wise enough to get out, when they have gone inside.

THE TRAWL IN ENGLAND NOT THE SAME AS IN AMERICA

We have told you that the trawl is a long line to which shorter lines are fastened. In Great Britain the word is used with a different meaning. There it means a great net in the shape of a bag, with a mouth sometimes a hundred feet, or even more, across. This is dragged along the bottom of the sea, and gets especially those fish which live on, or near the bottom, such as soles and flounders, which are not easily caught in other ways. Many cod and haddock are also caught in trawl nets. Such a net can only be used where the bottom is smooth, for a rough bottom would tear the net. The boat which carries one of these nets is called a trawler. Some are sailing vessels, but the large nets require machinery to draw them in, and so the number of steam trawlers has increased. Trawlers bring in three-fourths of the value of all the fish caught in Great Britain.

FISH OF THE PACIFIC AND OF THE GREAT LAKES

The most important fish on the Pacific coast is the salmon, which is little trouble to take. In fact this fish almost begs to be caught, as it goes up the rivers to lay its eggs. However, many of them are caught in nets in the bays. The salmon also takes the hook and puts up a game fight, but it is so easy to take in other ways, that few men fish with hook and line.

The Great Lakes are inland seas in size, even if the water is fresh, and many million pounds of fish are taken from these waters by fishermen from Canada and the United States. The whitefish, the lake herring and the lake trout are the most important varieties. They are taken with gill and pound nets, seines, and with hooks and lines. More are taken in by Canadian than by American fishermen.

HOW OYSTERS ARE RAISED FOR THE MARKET

The oyster fisheries of the United States are worth more than those of all the rest of the world. We show you some pictures of them, but more of the oyster fisheries of Europe. Oysters are scarce there, and they take more pains to rear them than on this side of the Atlantic.

For a long time oysters could be gathered from their natural beds so easily and so plentifully that no one thought of taking care of them. But so many oysters are eaten in the United States, and so many are destroyed and wasted in gathering them, that they have begun to grow scarce in some places. Heavy dredges are dragged over the bottom, and bury or break as many oysters as they bring up. The tongs and rakes also do some damage in this way.

Men, therefore, are sometimes allowed to mark out a space in the shallow water in which no one else is allowed to fish. If the bottom is soft they scatter gravel or empty oyster shells over it, and then scatter some full grown oysters for seed, as they say. Since a large oyster may lay as many as 60,000,000 eggs, one would think that they should increase very rapidly. Many of the eggs are eaten by fishes, however, many are carried away by the currents, and many never hatch at all. Those that do hatch swim about for a few days and begin to build a shell. Then, if they have not been eaten, they sink to the bottom and attach themselves to the old shells or stones. If there are none, they sink into the mud and die.

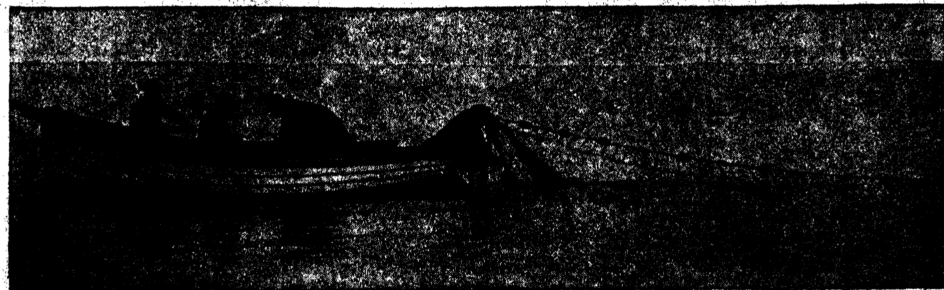
Such a bed as this may be left until the oysters grow large enough for market, but if it is found that a great many have settled down, some of the stones or shells with the young oysters sticking to them may be raked up and dropped in another bed, where they are allowed to grow. If the men who own the beds are careful and do not take out too many oysters, a bed will last a long time, as countless millions of tiny oysters begin their life every year.

You are sure to be interested in the pictures of the French fisheries. Oysters bring such a high price there, that it pays to take a great deal of trouble to raise them. In the United States and Canada oysters are too cheap to make so much care profitable.

If we only had room we could tell you an interesting story of the lobster and crab fisheries of the world. Many of you have seen the lobster pots in the water, and perhaps have seen the fishermen draw them up. Crab fishing in Japan is interesting, too, and much of the catch comes to the United States, but every story must have an end.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 4003.

CATCHING SPRATS OFF THE EAST COAST



In this picture we see a drift-net for sprats being let out from a boat. The net has pieces of cork placed at intervals along the top to keep it afloat, and one end of the net is fastened by a rope to the boat. The boat then drifts, and the fish, swimming against the net, get their heads caught in the meshes and cannot escape.

The net is then hauled in and the boatmen row ashore. Drift-nets are used only for fish that swim near the surface of the sea, like mackerel, pilchards, and sprats, and usually several nets are fastened together.

The boat on reaching shore is pulled up on the beach, and the sprats are then shaken out of the nets, ready to be sorted and packed for the market. The pictures on this page show sprat-fishers in England.

PACKING THE SPRATS FOR THE MARKET

Having shaken the sprats clear of the nets, the fishermen measure their catch in large metal cans, as shown in this picture. The fish are now ready to be packed and sent to the markets for which they are intended.

Here we see sprats being packed into boxes, ready for despatch to London. They are carried from the boat to the boxes in the metal pails used for measuring the catch, and when full the boxes are fastened. The quantities of fish caught vary very much, of course, but as many as fifteen tons have been caught in a single day by the nets of one boat. Many of the "sardines" that we buy are really young sprats packed in oil.

A GREAT HARVEST OF HERRINGS

Here we see a catch of herrings being landed on the East Anglian coast. These fish are caught by drift-nets, and they form the principal fishery of the United Kingdom. The value of the herrings landed in a year is equal to about $10,000,000. It is estimated that 2,200,000,000 herrings are landed in Britain in a season.

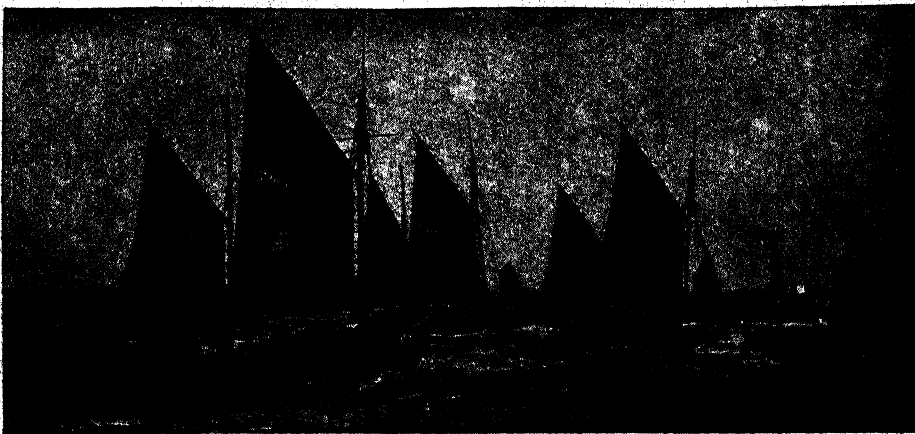
This great mass of herrings on the quay, waiting to be packed, will give some idea of how many fish are landed at once. Some time ago a single lugger brought to land a quarter of a million herrings, which realized $900, the result of a night's fishing. Herrings are caught principally in the North Sea, where they abound.

MILLIONS OF HERRINGS FOR THE SHOPS

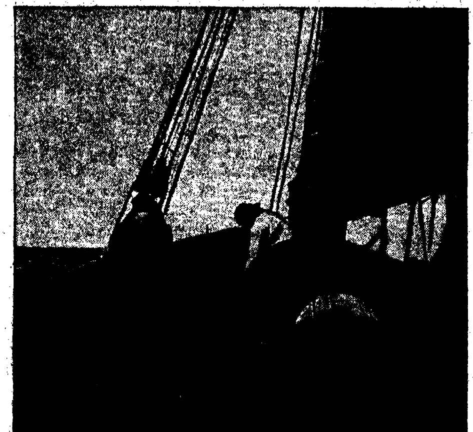
The herrings are landed on the quay, as shown on page 3846; the various sizes are sorted and placed in large tubs, ready to be sent off to London and other large towns. The principal centres of the North Sea fishery are Hull and Grimsby, which have more than $20,000,000 invested in steam-trawlers alone.

Here the herrings are ready for despatch, and there has been an excellent catch. The finest kinds of fish, such as soles, turbot, and brill, as well as haddocks, whiting, and cod, are caught by trawling—that is, by dragging a great net along the bottom of the sea. This can be done because nowhere is the North Sea so deep but that the cross of St. Paul's would show above the water if the cathedral stood on the bed of the sea.

TRAWLING-SMACKS & STEAM-TRAWLERS



Of all the British methods of fishing, trawling is the most important, and here we see a fleet of trawling-smacks in the North Sea. It is only since the middle of last century that trawling has come into general use. The word trawl means " to go hither and thither," and in trawling a net is dragged along the sea-bottom.

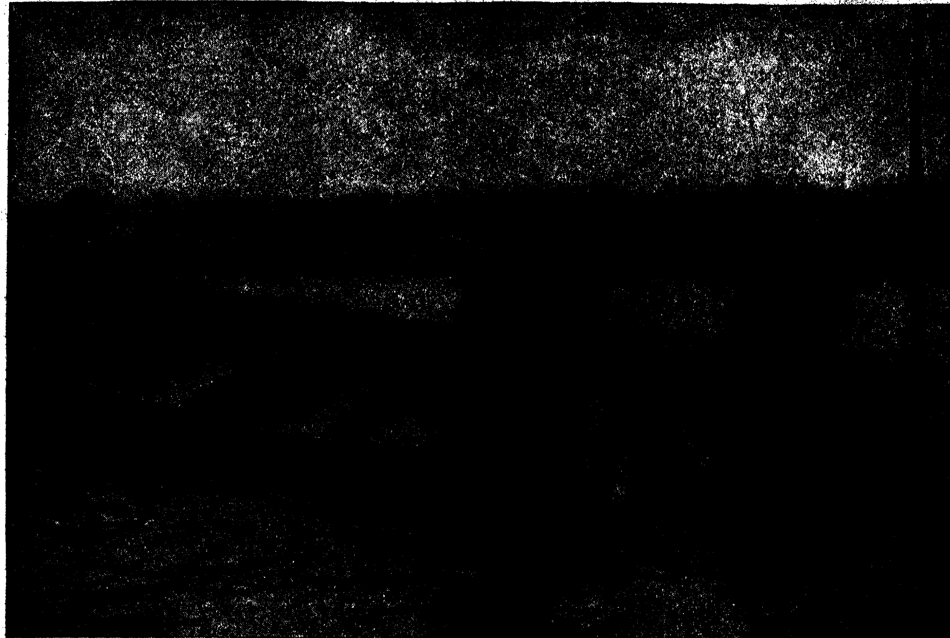


The finest fish, such as soles, turbot, and brill, are caught by trawling off the English coast. As the net is dragged along the sea-bed the fish are caught in the mouth of the trawl, which is then hauled on deck.

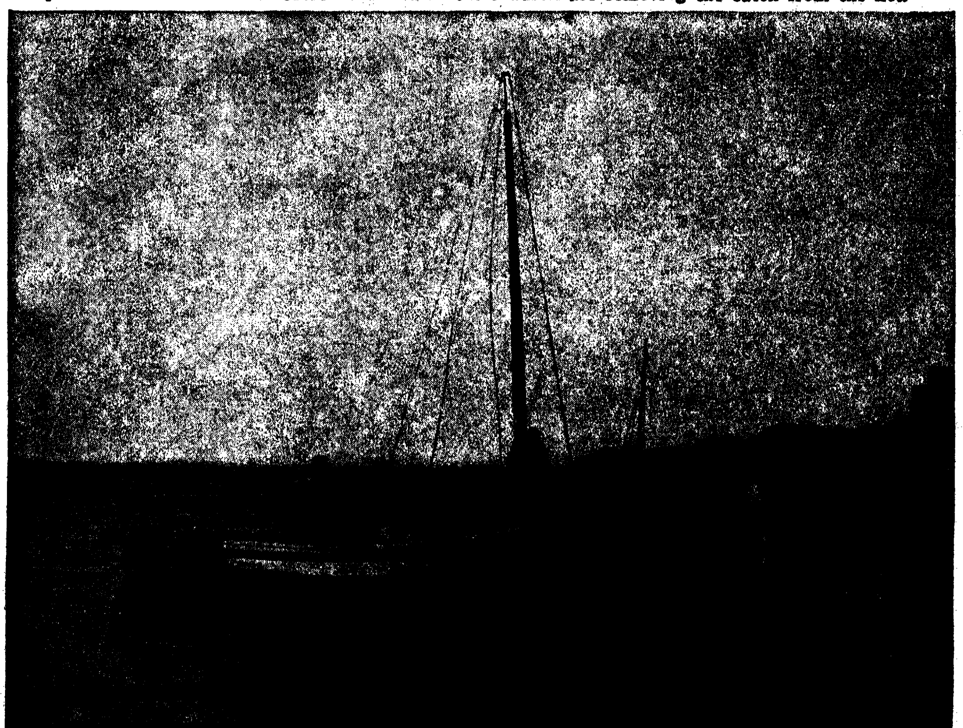
The trawlers remain at sea sometimes for weeks, and their catches are collected by steamers that take the fish to London. Ferrying the fish from trawler to steamer is often dangerous work, as we see here.

Sailing smacks are fast giving place to fine steam-trawlers like that shown in this picture. These vessels are expensive, but can do the work of several sailing boats. One steamer, after towing her trawl-net for only four hours, caught over seven tons of fish. Steam-trawlers began to be used at the end of last century.

FISH IN RIVER AND BAY IN THE EAST



The shad belongs to the herring family but is much larger. Every year they ascend the rivers to lay their eggs. Once they were very abundant, but the rivers have become dirty from the cities and factories on their banks, and so many have been caught that they are now becoming scarce. Nets attached to poles are placed across the rivers. Here fishermen in the Hudson are removing the catch from the net.



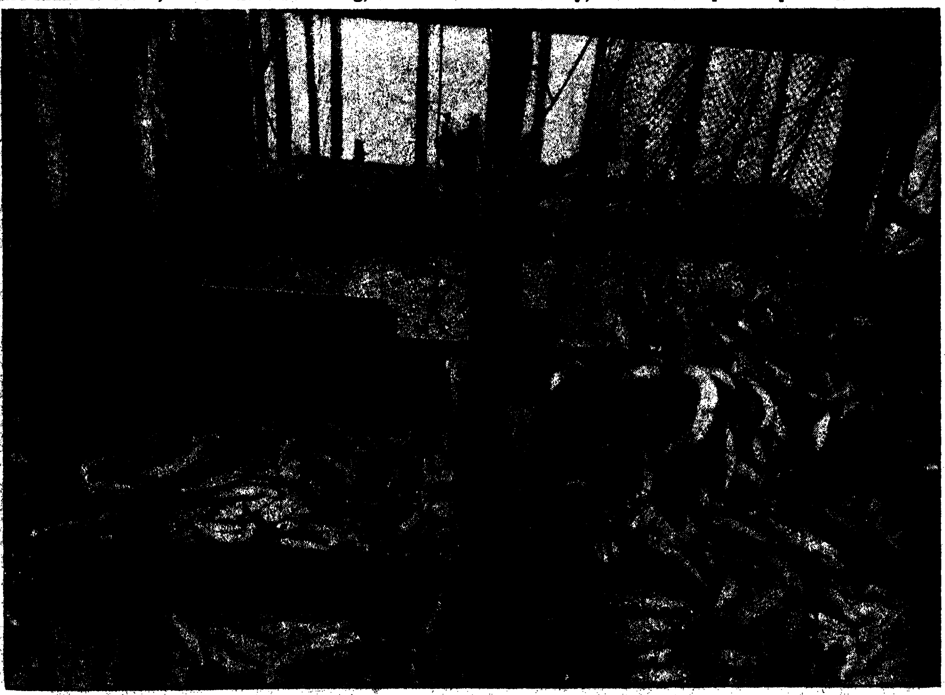
You have seen Cape Cod on the map, even if you have never visited that delightful region. This picture was made at North Truro, not far from the tip of the long arm. The soft beach does not injure the bottom of the boat, which has been pulled up on the sand. Provincetown lies beyond and to the left.

Pictures from Brown Bros.

FISHING UPON THE PACIFIC COAST

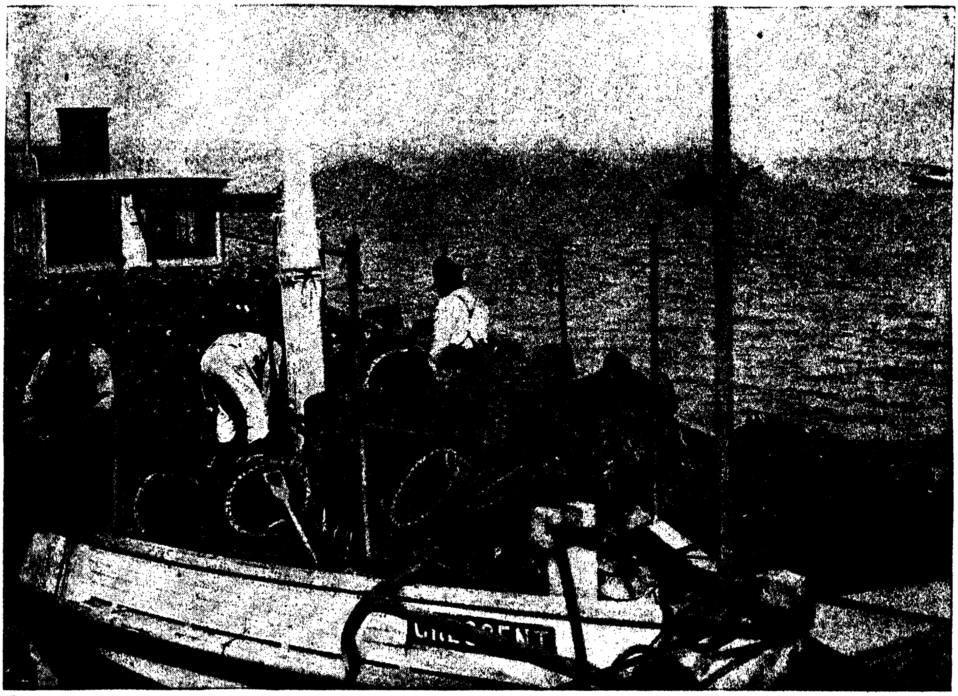
Picture from Brown Bros.

The fishing industry in the Pacific employs many men. Here we see an old netmaker mending miles of nets upon a wharf at San Francisco. A small break soon spreads and makes a net almost worthless. Nets are made of twine, which must be strong, and must not rot easily, for a net is quite expensive.



The most important food fish of the Pacific is the salmon, about which we have told you in several other places. They are easily caught in several ways. Here is one of the methods used in Oregon, where salmon are caught by the ton. The salmon which frequent Puget Sound and the Columbia River are especially prized for their flavor, and millions of pounds are preserved in tin cans and sent to all parts of the world.

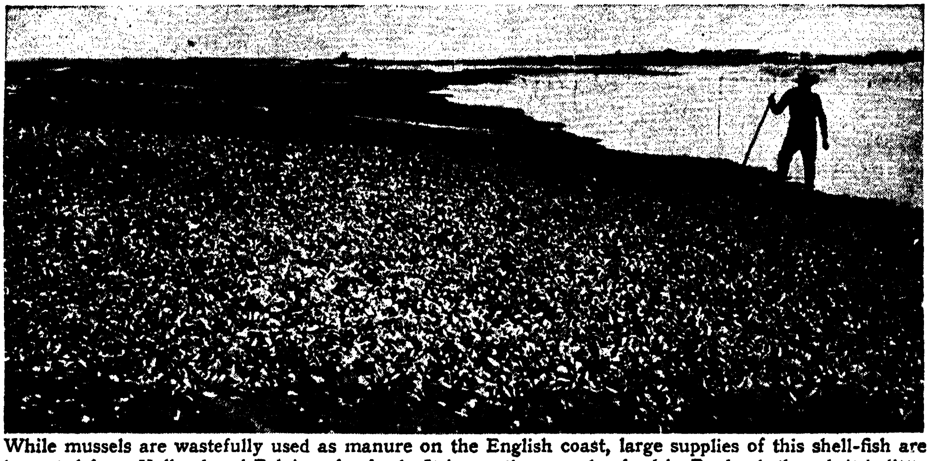
OYSTERS ON THE NEW JERSEY COAST



The United States produces and consumes more oysters than any other country in the world. This boat has been out to the oyster beds off the New Jersey coast, and has returned with a heavy load. The boat cannot go into the shallow water inshore, and the oysters, which you see heaped up, are placed in baskets. These are transferred to flat-bottomed scows, one of which is moored beside the boat.

In the oyster bed the oysters often lie in mud. Now they are dumped in the shallow water at the mouth of the creek, which washes them clean as the tide rises and falls. Then, too, if they are not needed at once they will remain alive here, but would die and become unfit for food if left long out of water. Soon they will be shipped to the city, either with or without their shells. Many thousand bushels are eaten daily.

GATHERING MUSSELS AT LOW TIDE



While mussels are wastefully used as manure on the English coast, large supplies of this shell-fish are imported from Holland and Belgium for food. It is a rather popular food in England, though it is little eaten in America and in Scotland. Here we see a large mussel-bed on the Belgian coast as it appears exposed at low water. In this country and in most European lands mussels are largely used as bait.

A Belgian woman gathering mussels from a natural bed of this shell-fish, found on a breakwater.

Mussels growing on a piece of wreckage that has been cast ashore and embedded in the sand.

A mussel-fisher of the Belgian coast gathering them at low water from the piles supporting a pier.

The people of Holland cultivate artificial beds of mussels, and here we see a Dutch mussel-farmer in his boat raking them up for market. The Dutch are successful at this artificial mussel-rearing, but it is interesting to know that they get a very large proportion of their spawn, or eggs, from the southeastern coast of England.

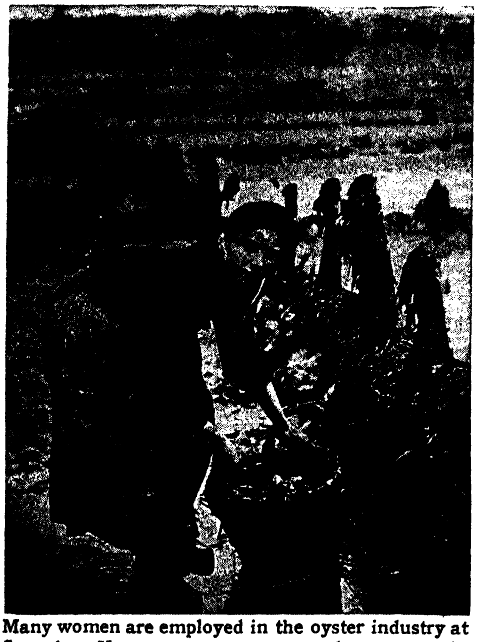
AT WORK ON A GREAT OYSTER FARM

On parts of the coast of France, oysters are reared artificially, and here we see, at low water, a corner of the great oyster nursery at Cancale, which is on the north of Brittany, opposite the island of Jersey.

Another famous French oyster fishery is that of Arcachon, on the Bay of Biscay, near Bordeaux. It is visited every year by thousands of strangers, to whom the picturesque oyster-women working in trousers, like men, are a familiar sight. They are here seen gathering the oysters from the beds for the market.

In this picture we see the rearing-cases used at Cancale. The spawn, which is known as spat, and really consists of eggs, is placed in these cases to hatch, and the oysters are kept here till they are six months old.

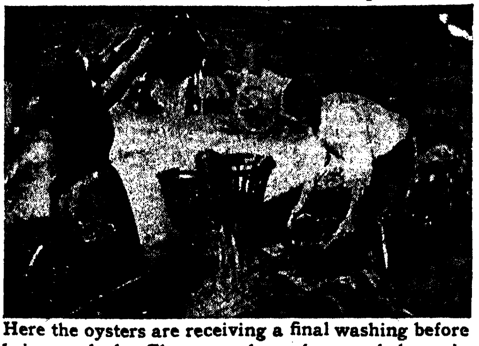
COLLECTING AND WASHING THE OYSTERS



Many women are employed in the oyster industry at Cancale. Here we see an oyster-gatherer at work.

After they are gathered, and before being packed for market, the oysters are washed in baskets.

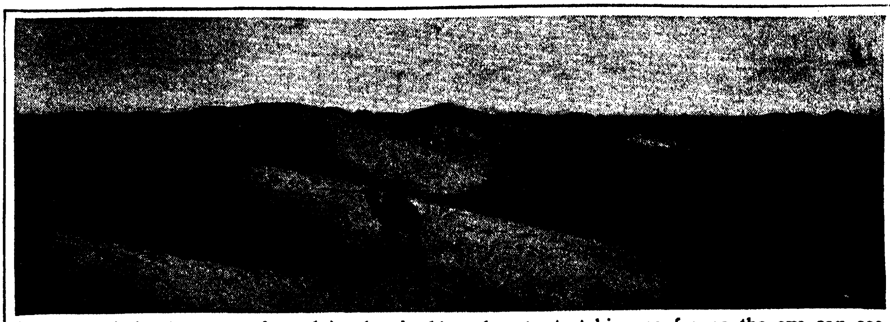
On page 3853 we see the rearing-cases where the spat, or spawn, is hatched. When the oysters are six months old they are removed, as is being done by the men in this picture, and placed in the oyster-beds.



Here the oysters are receiving a final washing before being packed. They are plunged up and down in the water and shaken in the cleansing-baskets.

At last, when the cleansing is complete, the oysters are put in square baskets, like the one seen in this picture, and wheeled on trucks to the packing sheds.

THE NEXT FAMILIAR THINGS ARE ON PAGE 4003.



A vast and desolate sea of sand in the Arabian desert, stretching as far as the eye can see.

PERSIA AND ASIATIC TURKEY

THE LANDS OF THE SULTAN AND THE SHAH

CONTINUED FROM 3806

WE already have some idea of the vastness of Asia, the huge continent four times the size of Europe. For in the story of India we have glanced at the majestic Himalayas, whose four chief peaks top all the other white-capped giants of the world; and in the story of Russia we have seen the stormy Caspian, the largest inland sea in the world. We have felt, too, the chill of the coldest climate in the world as we traveled, in imagination, by the longest railway in the world, from the Urals to the Pacific.

Let us now turn to the south-western part of the continent, girdled by the Caspian, the Black, the Mediterranean, and the Red seas, the Persian Gulf and the Indian Ocean. The mass of land thus bounded takes in the western peninsula of Asia Minor, whose northern shores approach within sight of Europe; Syria, bordering the extreme east end of the Mediterranean; the immense southern peninsula of Arabia, between the Red Sea and the Persian Gulf; Mesopotamia, the country lying in the valleys of the two great rivers, the Euphrates and the Tigris; and Persia, between the Caspian and the Indian Ocean. The land frontiers of Persia march with those of Russia on both sides of the Caspian, with those of Afghanistan and Baluchistan, two states on the borders of India, and with those of Turkey on the west.

For, to-day, Asia Minor, Syria, Mesopotamia, and a part of Arabia form the Asiatic dominions of Turkey, which are about one-fifth the size of the United States. Persia is an independent kingdom, one of the oldest in the world, and it is about twice as large as Germany. One of the reasons why travelers visit these parts of South-west Asia is to study the story of the past that is told by the remains found there. We shall see later on how interesting are these remains, some buried for centuries below the dust.

How long ago this part of Asia was first peopled no one can tell. Some say the Garden of Eden was watered by its chief river, the Euphrates. On one of its heights, Mount Ararat, where the present-day dominions of Russia, Persia, and Turkey meet, the Ark of Noah is said to have rested. The Tower of Babel is said to have risen towards heaven from the plain of Mesopotamia.

It was from his home in a city of Mesopotamia, near the Persian Gulf, that the patriarch Abraham, the founder of the Jewish faith, wandered forth at God's bidding. He led his flocks and herds in search of pasture across the narrowest part of the Syrian desert, which joins that of

Arabia, till he settled in Palestine, or Canaan, whence his descendants, carrying with them the old faith and its customs, have spread all over the wide world. Abraham's country received yet another name in after years—the Holy Land; for here, some twenty-four centuries after Abraham slept in his ever-shifting tent under the brilliant, starlit sky, Christianity was founded in the great days of the Roman Empire. Here was born, and lived, and labored, and here died, Jesus Christ; and for nearly 2,000 years pilgrims have visited, with deep interest and devotion, the scenes of His early and lowly life at Bethlehem, at Nazareth, at Jerusalem, and other places.

SOUTH-WESTERN ASIA, WHICH WAS THE CRADLE OF TWO GREAT RELIGIONS

His disciples carried His teaching through some of the provinces of Asia Minor and round its Mediterranean coasts, where the wavy shores and countless islands have just the same soft beauty as those of Greece across the Archipelago. From Greece the religion of Christ spread to Rome; from thence over the world; and, in the chapters of the Bible, men of all races have become familiar with the various features of Palestine, with the desolate salt lake known as the Dead Sea—nearly 1,300 feet below the level of the Mediterranean—the River Jordan, and the shining Lake of Galilee among the hills.

The third of the great world religions that have sprung from South-western Asia arose about 600 years after Christ, from Arabia, when Mohammed, the camel-driver, a man of immense personal power and enthusiasm, announced his message: "There is but one God, and Mohammed is His prophet." His teaching soon spread far and near, and South-western Asia has remained ever since so much the heart and centre of Mohammedanism that the history of its countries is closely bound up with the history of the progress of that religion.

THE NARROW CHANNEL THAT SEPARATES EUROPE FROM ASIA

But before going into that history, let us take a rapid glance over the surface of the lands that are so interesting to lovers of ancient life, and to Jews, Christians, and Mohammedans alike.

Shall we start from Constantinople, the capital of the Turkish Empire, in which Europe and Asia meet? As we know, it is but a short ferry across the Bosphorus to its Asiatic suburb of Scutari, which stands on the same rocky mass as Stamboul in Europe, with but a narrow cut between, by which the waters of the Black Sea pass to the Mediterranean.

If we could sweep over this part of the country in a flying machine, we should see that the ridges of mountains encircling the central plateau of Asia Minor have many points in common with the mountains of the Balkan peninsula, the mountains which caused so much isolation in former days. Let us note the deep, marshy plains near the blue sea, separated by shaggy mountains, the rivers running in deep gorges in the uplands—like those of Spain—where a brown dryness spreads over the earth. In other parts we see smiling and fertile valleys, rolling, grassy highlands, topped by bare, rocky peaks.

It is said that there is not a spot of ground in this peninsula of Asia Minor that does not contain some relic of the stirring events which have swept over it for thirty centuries. For it has been not only the battlefield of powerful nations, but the home of the beautiful arts of peace and culture, which crossed to and from Greece by way of the lovely islands of the Archipelago.

THE GREAT SALT DESERTS OF PERSIA WHERE NOTHING WILL GROW

The highlands of this western peninsula stretch onwards and southwards to the beautiful forest-clad mountains of Lebanon in Syria, and eastwards to the high plateau of Armenia, connected with the Caucasus range. Skirting the base of the Caspian, the highlands spread over the greater part of Persia, sinking southwards into the Indian Ocean, and rising in the east to the highest mass of land in the whole world.

A rich tract of land lies round the south of the Caspian Sea, shut in by the Elburz range; and some other parts of Persia are very fertile too. But the greater part of the country consists of high and dreary plateaus and deserts; in the east these tracts are full of salt, where nothing will grow.

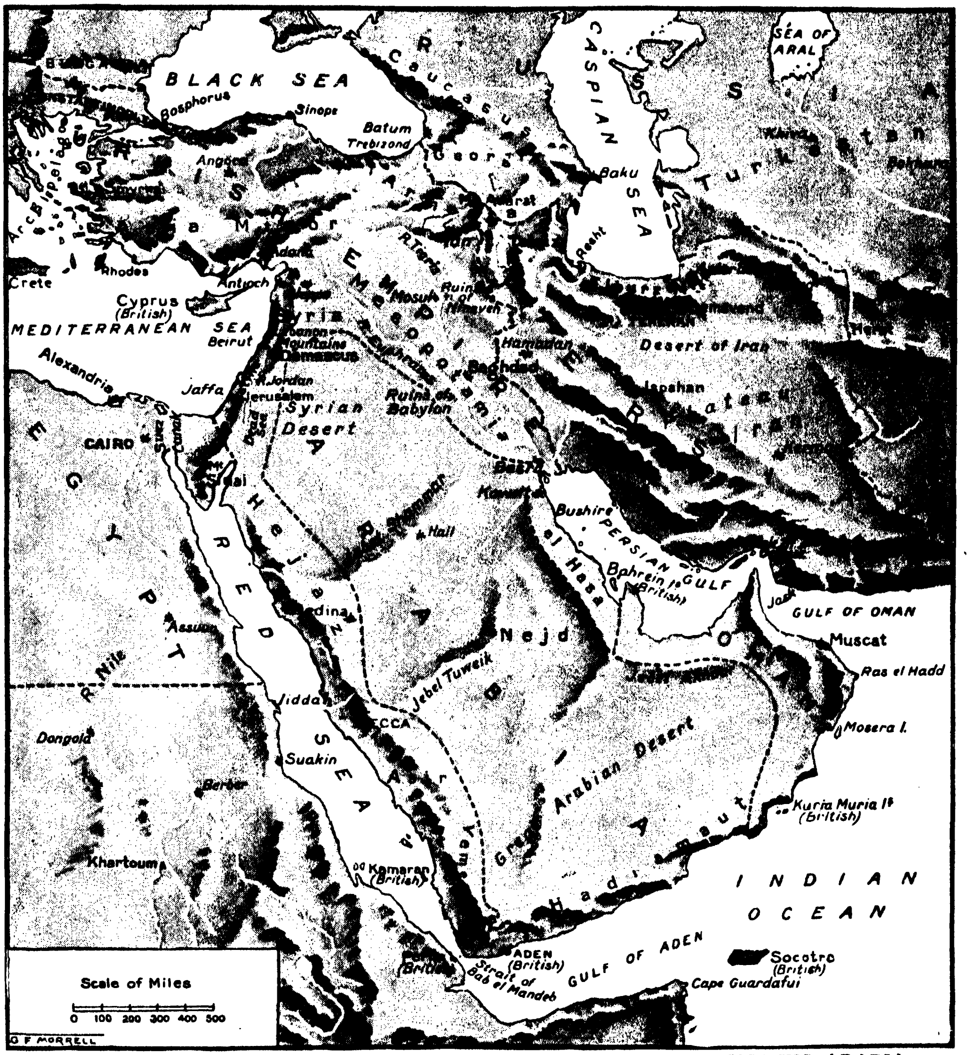
Mesopotamia, the land of the two great rivers, separates the highlands of Persia, or Iran, as its inhabitants call it, from those of the immense southern

peninsula of Arabia. To-day, Mesopotamia is chiefly a dry and dreary country, with very few people living in it, and its fields beyond the river-banks are little cultivated. In Abraham's time, and earlier and later too, there were thousands of people living in great cities, whose buried ruins now dot the desolate landscape; others worked in the rich green fields and orchards and farms, watered by a wonderful system of canals and ditches and other channels.

Arabia is said to be a million square miles in extent—ten times the size of New York, New Jersey, and Pennsylvania. It consists of a high tableland in the interior, with a fringe of fertile lowlands and valleys on parts of the coast, especially to the south. Rocky plains, stony peaks, and naked cliffs are found all over this tableland, as well as wide stretches of grass where flocks and herds find pasturage; and here and there are cultivated patches of land, where water can be obtained.

In the deserts of the interior neither vegetation nor animal life can exist. The yellow sands reflect the glaring sunlight until the eyes ache and the senses reel. The heat is insupportable, and many a large caravan has been lost in the terrible sand-storms which rage from time to time.

It is only the outside rim of the country, and the mountain terraces above it, that can be called Arabia the



MAP SHOWING PERSIA AND THE TURKISH EMPIRE IN ASIA, INCLUDING ARABIA

Blessed, or Happy. Here the cool sea-breezes temper the heat, and the thirsty soil has enough to drink. Coffee-gardens, date-groves, cinnamon-trees, and other spices all flourish on the edge of Arabia. An old writer even speaks of the sailors out at sea enjoying the odors of the sweet spices wafted to them from these luxuriant coasts.

CARAVANS OF PILGRIMS THAT CROSS THE DESERTS TO THE PROPHET'S SHRINE

We have spoken of the Christian pilgrims who visit the Syrian Holy Land. These are few and far between, compared with the numbers of Mohammedan pilgrims who visit their Holy Land of Arabia. Every good Mohammedan hopes to visit Mecca and Medina, the birth-place and burial-place of the Prophet, before he dies; and the desert routes are crossed by caravans of camels, from oasis to oasis, from Baghdad on the Tigris, from the Persian Gulf, from Damascus, bringing pilgrims from India, Persia, Central Asia, and far-spreading Turkey. Those from Egypt cross the Red Sea to Jiddah, the port of Mecca.

For centuries before the birth of Mohammed at Mecca, this town had been looked upon as a holy spot; and its temple—the kaaba, with its famous black stone—was a place of pilgrimage for tribes and peoples of varying beliefs who lived in Arabia and beyond. The wildest of these tribes wandered about the sun-baked interior, as they do to-day, seeking pasturage for their flocks and herds; the more civilized ones were partly settled in the fertile spots, tilling the ground and farming.

One of the first objects in the Prophet's life, after persuading his own family of his great mission, was to induce his countrymen to give up the idolatry that was carried on at the kaaba, and to worship only one God. Of this we read on page 3029.

HOW THE PROPHET OF ARABIA FLED FROM HOME TO SAVE HIS LIFE

He also tried to persuade them to sink differences and to unite as one nation. As is the case with all reformers, Mohammed had to face much opposition and great dangers. He had to flee from Mecca to Medina, on an oasis further north, to save his life. This is called the Hegira, or Flight, and it happened in 622. His followers all over the world date their years from the Hegira, as Christians date the calendar from the birth of Christ.

Mohammed died eleven years after the Hegira, without naming a successor, and he left no son. The first three caliphs, or successors, were: his father-in-law, Abu Bekr; his friend, Omar; and his son-in-law, Othman.

The fourth caliph was Ali, cousin and son-in-law of the Prophet. Many who held that Ali ought to have been the immediate successor of Mohammed looked upon the first three caliphs as usurpers. From early days Mohammedans split into two great sects on this difference; and bitter feelings were made worse by the death in battle of Hosain the son of Ali. His followers called his death a murder.

The teaching and the conquests that Mohammed began, spread with most amazing rapidity under these first caliphs. "During the reign of Omar," says an old writer, "the Arabs conquered 36,000 cities, towns, and castles, destroyed 4,000 Christian and other temples, and built 1,400 mosques."

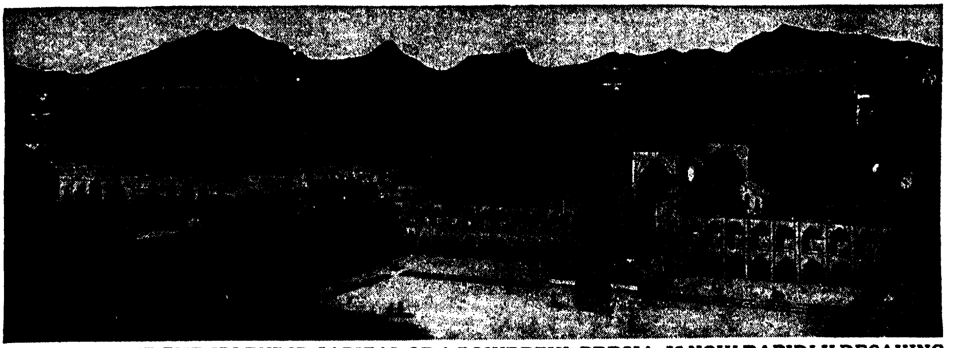
THE FIERCE MOSLEM CONQUERORS WHO BROUGHT FIRE AND SWORD TO EUROPE

Nothing stopped the enthusiasm with which they sought battle and danger. Syria fell to their arms; and the provinces of Asia Minor were all won from the decaying Eastern Empire. The fire of conquest spread into Egypt, thence along the north coast of Africa, and across the Straits by the Pillars of Hercules into Spain and to France. Eastwards the blazing power of Mohammedanism spread across the country of the two great rivers into Persia.

We have read of the long wars between the Greek emperor and the Persians, and of the story of the piece of the true Cross, and of how Shireen, the Christian wife of the sun-worshipping Persian king, had to give it up. In the course of these wars the Persians gained from the Eastern emperor all the lands that had been won through the centuries by the Romans; and the Persian king, who had marched victoriously from the Euphrates to the Bosphorus, called himself the "Asylum of the Universe."

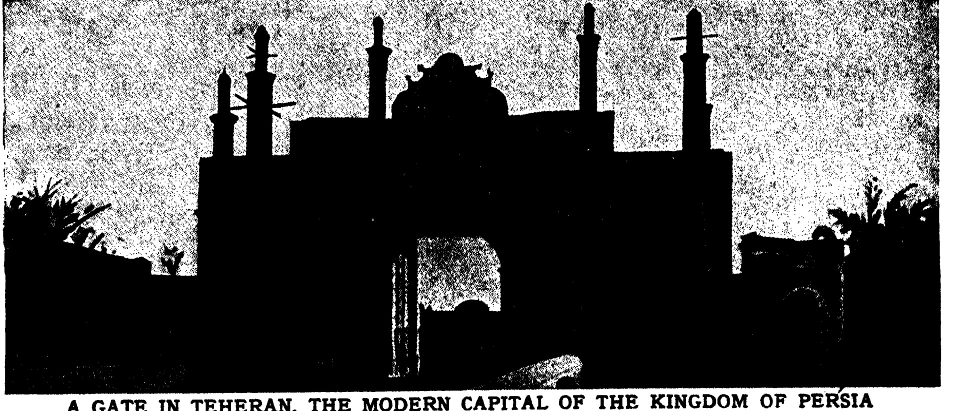
In the year that Mohammed made his famous flight from Mecca, the "Asylum of the Universe" stood on the Bosphorus, with just a mile of water between him and Constantinople. The heroism

SOME FAMOUS CITIES OF THE NEAR EAST

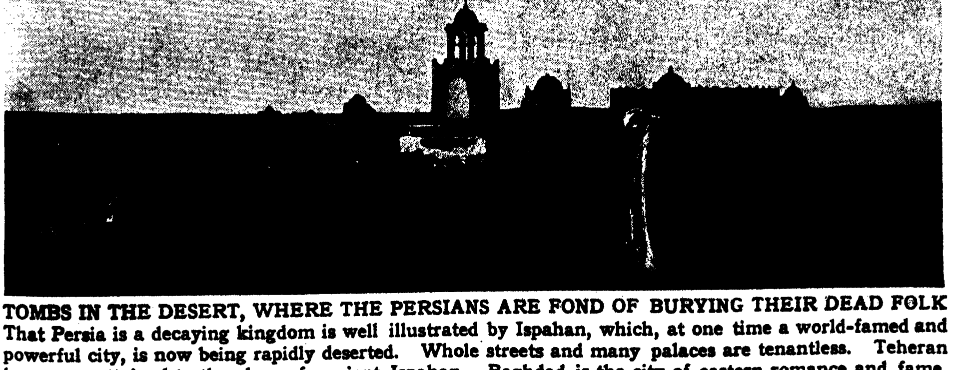


ISPAHAN, ONCE THE SPLENDID CAPITAL OF A POWERFUL PERSIA, IS NOW RAPIDLY DECAYING

*A DISTANT VIEW OF BAGHDAD, SHOWING THE BRIDGE OF BOATS OVER THE TIGRIS



A GATE IN TEHERAN, THE MODERN CAPITAL OF THE KINGDOM OF PERSIA



TOMBS IN THE DESERT, WHERE THE PERSIANS ARE FOND OF BURYING THEIR DEAD FOLK

That Persia is a decaying kingdom is well illustrated by Ispahan, which, at one time a world-famed and powerful city, is now being rapidly deserted. Whole streets and many palaces are tenantless. Teheran has never attained to the glory of ancient Ispahan. Baghdad is the city of eastern romance and fame.

and genius of the Emperor Heraclius turned the scale and saved the capital and empire; and Chosroes II. had to retire to his own country and be content with its limits and his grand palaces, adorned with the spoils of the treasure-houses of many nations.

Suddenly, in a most tragic way, the splendor of the Persian kingdom came to a miserable end; for only a few years after the torch had been lighted by the Prophet, his successors, burning with zeal, turned their arms against Persia, and shattered the hosts arrayed against them, despite the desperate valor of the Persians and the heavy charges of the lines of elephants.

The Mohammedans crushed the old fire-worship of the Persians. Some few of the old faith remained steadfast in their own country; and many fled to India, where their descendants to this day are known as Parsees, or Persians. Thus, Persia—that most ancient kingdom—passed under Arab rule, though often, during the eight centuries that followed, the governors of different provinces were practically independent.

THE SPLENDOR OF THE CALIPHS AND THE GREAT LEARNING OF THEIR PEOPLE

The caliphs who ruled over South-western Asia shifted their capitals from time to time, and we catch glimpses of the splendor of their courts at Damascus, in Syria, and Baghdad, on the Tigris. It is at the latter place that we meet the Caliph Harun al Rashid, surnamed the Just, the Upright, the Great. He made a treaty with Charlemagne, and was the hero of many of the stories of the Arabian Nights. He twice crossed the mountains of Asia Minor and defeated the Greek emperor Nicephorous. He was a great patron of the arts and of the learning for which the Arabs became so famous. It is to them we owe the figures we use in place of the more cumbersome Roman numerals. It is said they first found out how to use the compass, and introduced the use of paper, which they learned how to make from the Chinese. Their researches in mathematics and astronomy paved the way for all future study; and the traces of their wonderful architecture and skill in decoration are still a delight, wherever we find them, from Persia to Spain.

About the time when the Normans were intent on conquering England, a race called the Seljouk Turks made their way from the East. They early became Mohammedans, and overthrew various states in Persia, conquered Armenia and Georgia, and overran Asia Minor and the surrounding territories.

HOW THE CALIPH OF BAGHDAD GAVE HIS POWER TO THE TURKISH LEADER

It was in 1055 that a dramatic scene took place in Baghdad, when the Caliph Kaim, to escape further troubles, put himself under the protection of the leader of the Seljouk Turks, and gave up to him the temporal power of the caliphs. The Seljouk kissed the dust before the caliph, then ascended the throne and received the two crowns of Persia and Arabia. Many mosques and colleges rose up in Baghdad, new roads and canals were made, and the boundaries were extended in all directions.

It was the action of these Seljouk Turks on the Christian pilgrim routes through Asia Minor and in the great centre of Jerusalem that inflamed Western Europe to start on the famous Crusades. Arabs and Turks united against the Christians, and much terrible fanaticism was aroused. The hero of the Mohammedans in these long wars was Saladin, famous for his courage, his justice, and his fidelity to his plighted word. On the Christian side there rise before us the forms of Godfrey of Bouillon, the lion-hearted Richard; the German Frederick Barbarossa, who was drowned off Asia Minor; the Prince of Wales, afterwards Edward I., and Louis XI., St. Louis of France.

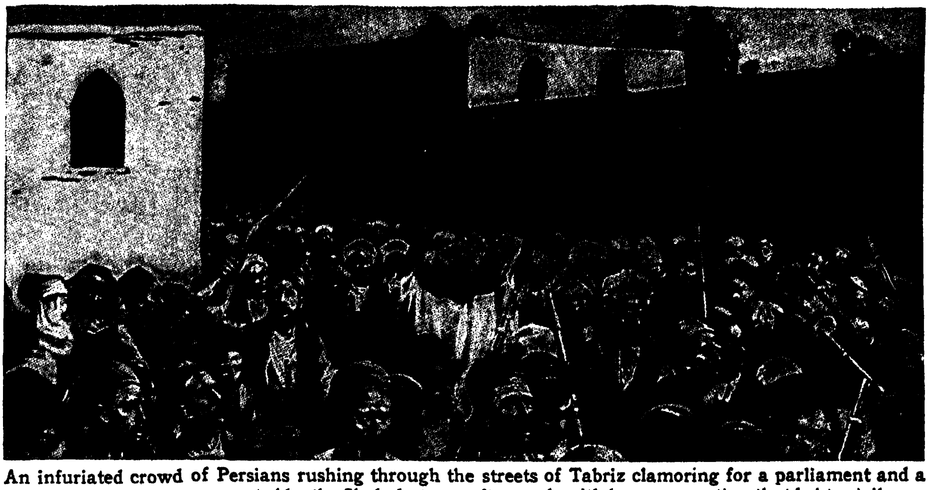
Barely two centuries after the rise of the Seljouk Turks a fresh wave of conquerors swept from the unknown East over Persia and the rest of South-western Asia. These were the Mongols, under their leader, Jenghis Khan. Province after province fell before them. Baghdad was captured and destroyed, and the valuable library of the caliphs burned.

THE COMING OF THE TARTARS AND THE FURY OF THEIR CONQUEST

Western Asia became more and more desolate under the fierce and bitter struggles of the various parties seeking power; and in 1387 a fresh horde of Mongolian Tartars poured over the whole country in a perfect storm of conquest, under Timur, or Tamerlane.

A new race of Turks called Osmanli, or Ottomans, after their first independent

THE PEOPLE OF PERSIA AND ARABIA



An infuriated crowd of Persians rushing through the streets of Tabriz clamoring for a parliament and a constitution. This was granted by the Shah, but was afterwards withdrawn, an action that led to civil war.

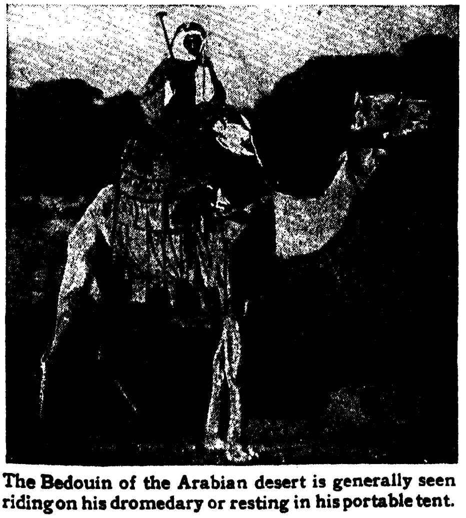
A wealthy Persian merchant of to-day.

Armed caravan guide of Arabia.

A group of Bedouins from the Petra district in Arabia.

A poor peasant woman of Persia.

A wealthy Persian lady of high rank.



The Bedouin of the Arabian desert is generally seen riding on his dromedary or resting in his portable tent.

The Arab carries everything belonging to him upon his camel—his wife and family, his clothes and house.

leader, Osman, or Othman, had arisen in Asia Minor about fifty years before Timur's appearance, and had conquered most of the provinces in Asia Minor and also threatened the destruction of the European possessions of the Eastern Empire, as we read in the story of the Balkan Peninsula on page 3190.

THE FALL OF CONSTANTINOPLE AND THE MAKING OF MODERN TURKEY

But the conquests and fury of the Mongols delayed the taking of Constantinople and the final fall of the long-dying Eastern Empire yet another fifty years, during which time the state of Asia Minor, of Syria, of Mesopotamia, and of Persia was very grievous.

By degrees the Ottoman power rose again. Constantinople fell in 1453; and the various provinces known to-day as Turkey in Asia were gradually gathered into the grasp of the Turkish despots. We have seen what their rule was in Europe. It brought much the same deadlock of despair in Asia. Towns, once flourishing, lost their trade, and the fairest plains were left without cultivation; canals became choked; roads were neglected; the inhabitants, ground down with taxation and unjust misgovernment, became apathetic and idle about work; and hostilities between different tribes and peoples were ever breaking out, to the misery and loss of all.

The Armenians, who clung with firmness to the Christian faith, for centuries have suffered cruel persecutions, plunderings, and attempts at extermination. In Syria, neither the mountain tribes of Lebanon nor the Arabs of the steppes have been willing to accept the Turkish yoke; and many have been the struggles, and rebellions, and bitter revenges that have taken place.

HOW THE LAND OF THE MOSLEM CONQUERORS SANK BACK INTO OBSCURITY

Turkish pashas, or governors, have been quite incapable of dealing with the difficulties of restoring Mesopotamia to prosperity; and Arabia, left to itself, sank into the insignificance of small independent states, which were for the most part hostile to each other. In the desert interior, the old Arab tribes and clans, headed by their sheikhs, have roamed on as their ancestors did of old, moving their tents of goats' hair at will, quarreling about pastures and wells, and living a simple, pastoral life. In 1916 many of them rebelled against the Turkish power.

In Persia the long centuries of crushing dependence came to an end when the Mongol rule gave way to a national government under Ismail, at the opening of the sixteenth century. He took the old Persian title of shah. It was not long before progress was made in enlarging the borders of the kingdom towards Georgia and Mesopotamia.

Queen Elizabeth sent envoys from England, hoping to open up trade and gain a footing in the East. The greatest of the Persian shahs, Shah Abbas, ruled in those days, and he not only extended his dominions, but did much to promote prosperity within them. He made roads and bridges, practically rebuilt the beautiful city of Ispahan, encouraged the silk industry for which Persia had been famous in the past, and furthered trade with Russia. Persian troops, in conjunction with an English fleet in the Persian Gulf, drove the Portuguese from their settlement at Ormuz. Pearl fisheries are still carried on in the Persian Gulf, and most of the ships on these waters are British.

THE FALL OF PERSIA FROM ITS GREAT POWER TO ITS PRESENT WEAKNESS

Before long, new enemies threatened Persia. The Afghans, a practically independent people on the Indian frontier, boldly laid siege to Ispahan, which they entered in triumph. For many years there were bitter quarrels about the form of Mohammedanism that should be followed and about the succession to the throne. At the end of the eighteenth century the capital was transferred to Teheran; and the kingdom, little by little, lost its western provinces. Russia crept over the Caucasus and annexed part of Armenia; the land east of the Caspian also fell under the influence of Russia.

We have, perhaps, a general idea of the strong contrasts of Persia; of the wide-spreading deserts, crossed by caravans, carrying silks and carpets, dates, and embroideries to the ports on the Caspian and Black Seas; of the fertile patches, or oases; of the far-scattered towns. We now want to see everything closer, to meet the people, and understand, as far as we can, how absolutely different Persia is from anything we know in the West. Railways

not being available, for there are at present only two short lines, let us join in imagination an adventurous motor-car party, determined to penetrate to Ispahan, in the very heart of Persia. It needs some courage, for the roads are generally bad, and accommodation and food are very poor.

We must pass over the pleasures of running round the south of Russia, the tossing on the Black Sea, the run by train from Batum to Baku, the smell of the oil in the puddles, the difficulties on the Caspian, especially in landing the car on Persian soil. Round the south of the Caspian, the Garden of Persia, we pass through a paradise of green vegetation of every kind, from rice-fields, shimmering in water, to stretches of daisies, lilies, irises, so high that one can easily be lost in them; and everywhere are lovely lilacs and other flowering trees, in which the nightingales sing. But this is only one aspect of Persia, as we soon discover when we push on through the mountain barrier that guards the great plateau of Iran; and we shall be lucky indeed if the car does not break down with bounding from rock to rock or sinking into the stiff mud of the almost neglected roads.

A LAND OF CAMEL CARAVANS, WHERE THERE ARE NO HOTELS

If it does break down, the only alternative is to hire a native carriage, without springs, and change horses at the post-houses; and a long and wearisome journey it is, for hotels and inns, as we understand them, are unknown. Day after day we plod along over the stony desert, occasionally relieved by dark forests and spots of cultivation. In the distance we see dry and grim-looking mountains. And the sun pours down in intense heat, so that the caravans with the camels which we meet only travel by night.

It is a relief to see the white-pointed peak of Demavend, and at last to enter Teheran. Under its sky of fixed blue, the roses flower for which Persia is so famous—hedges and gardens with great masses of them—and the fresh, dry air makes us ready to enjoy everything. The palaces and gardens are very fine, also the beautiful lustre pots, and beautiful old stuffs, brocades, and carpets that we are invited to buy. And the crowds that pass! These are so different from any we have seen before. Besides the interesting camels and grey donkeys, there are women with long, thick white veils and full black cloaks covering them up completely; and men of different nationalities—Hindoos, Turks, Mongols—besides the Persians in their high black hats and brown flowing robes. The descendants of the Prophet are everywhere, in their turbans of blue or green; and the mullahs, or priests, are conspicuous in their white headgear among the crowd.

A GARDEN CITY IN THE MIDST OF A DREARY DESERT

But our object is to push on to Ispahan, over many more miles of burning desert, with the sand too hot to touch, though at night the air is crisp and dry, and the deep sky is simply blazing with stars. Every now and then there is the joy of an oasis, with its limpid streams and little village surrounded by fields of corn and rye and cheering wild flowers. When these are passed, there is again the smarting heat, the burned-out-looking mountains, with their sheer walls of every shade of dull red and dark purple, and not a tree or blade of grass to lighten the desolation.

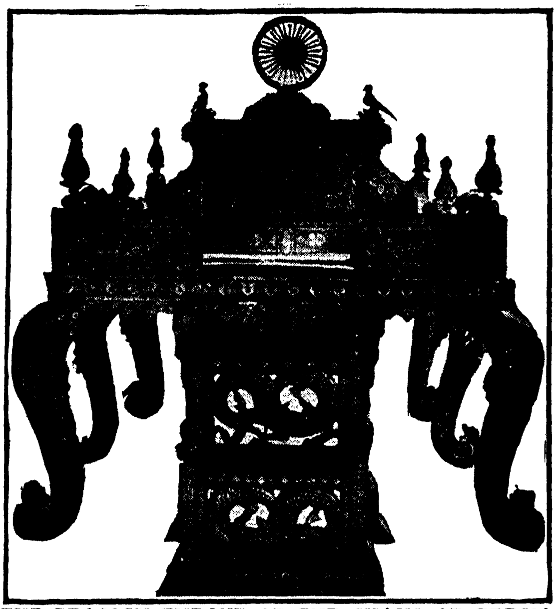
At last we see the domes of the mosques of Ispahan between the trees, and turning from the bare mountains in the distance, which now look as if bathed in gold, we do not know what to enjoy most. The avenues of trees, the fields of roses and white poppies, the gardens, the pale green streams and canals, the buildings of the great Shah Abbas, which date from the end of the sixteenth century—everything is wonderful and interesting. The enameled tiles and plaques, the blue cupolas and minarets of the mosque, the fine square, all fill us with admiration; and there are also the immense bazaars, where we can buy everything under the sun, and where potters, and weavers of cashmeres and carpets, and leather-workers are all following their interesting and useful trades.

HOW THE CHILDREN LEARN IN THE SCHOOLS OF PERSIA

In most of the schools in Persia only little boys are taught to read the Koran, which they chant as they swing to and fro in imitation of the prophet on his camel, as he fled to Mecca. But gradually a desire for education has grown, and there are now a number of very good schools for girls, as well as for boys, where many things are taught.

Persia is one of the countries which has recently gained a constitution. One was granted to them in 1906, signed by the Shah and his son, but it was of very little use to the bulk of the people; and fresh attempts on the part of the people to win freedom drove the old Shah from his throne and put a boy in his stead.

The Russians and the British, whose possessions touch Persia on the north and east, have agreed that its independence shall be respected. But the country is deeply in debt; it was drawn into the Great War, and it is feared that it may be many years before it can become even moderately prosperous. An election was held in 1914, the year in which the young Shah was crowned, and an attempt is being made to govern the country with the aid of the Cabinet and National Council, as the Assembly is called in Persia.



THE PEACOCK THRONE OF THE SHAHS OF PERSIA

The people of all these countries of Western Asia belong to a number of different races. They have been utterly crushed by many centuries of despotic rule. They do not know what it is to govern themselves, and the reformers who would teach them the responsibilities as well as the blessings of self-government have a most difficult task before them, and one that will take many years to accomplish, but will free Western Asia.

PERSIAN REBELS DISCUSSING PEACE TERMS WITH THE REPRESENTATIVES OF THE SHAH

During the civil war in Persia for a constitution and a parliament, the British consul at Tabriz arranged a meeting between the rebel leaders and the representatives of the Shah. Here we see the delegates seated upon a rich Turkish carpet with no other furniture, smoking their hookahs, or Eastern pipes.

THE NEXT STORY OF COUNTRIES IS ON PAGE 3923.

A SELECTION FROM HIAWATHA

THE scene of this poem is laid among the Ojibways, an Indian tribe on the southern shore of Lake Superior, in the region between the Pictured Rocks and the Grand Sable. The song is founded on a tradition that Hiawatha, a great warrior and teacher of mysterious origin, was sent to instruct the Indians in the arts of peace. He invented the birch bark canoe, and taught the people how to clear their watercourses and fishing grounds. When rumors of war arose he went with his daughter to attend a council of braves. As he stepped from his canoe, a huge white bird dropped upon his daughter, and crushed her to earth, and when the bird's body was lifted no trace of the girl could be found. Hiawatha silently bore his grief, but later called together the Five Tribes and gave them a plan of union. Then he bade them all a solemn farewell. Around this legend, Longfellow has woven many tribal myths. Hiawatha, the Wise Man, was the son of Mudjekeewis, the West Wind, and Wenonah, the daughter of Nokomis.

THE SONG OF HIAWATHA

HIAWATHA'S CHILDHOOD

CONTINUED FROM 3795

BY the shores of Gitche Gumee,
By the shining Big-Sea-Water,
Stood the wigwam of Nokomis,
Daughter of the Moon, Nokomis.
Dark behind it rose the forest,
Rose the black and gloomy pine-trees,
Rose the firs with cones upon them;
Bright before it beat the water,
Beat the clear and sunny water,
Beat the shining Big-Sea-Water.
  There the wrinkled, old Nokomis
Nursed the little Hiawatha,
Rocked him in his linden cradle,
Bedded soft in moss and rushes,
Safely bound with reindeer sinews;
Stilled his fretful wail by saying,
"Hush! the Naked Bear will get thee!"
Lulled him into slumber, singing,
"Ewa-yea! my little owlet!
Who is this, that lights the wigwam?
With his great eyes lights the wigwam?
Ewa-yea! my little owlet!"

. . . .

  At the door on summer evenings
Sat the little Hiawatha;
Heard the whisperings of the pine-trees,
Heard the lapping of the water,
Sounds of music, words of wonder;
"Minne-wawa!" said the pine-trees,
"Mudway-aushka!" said the water.
  Saw the fire-fly, Wah-wah-taysee,
Flitting through the dusk of evening,
With the twinkle of its candle
Lighting up the brakes and bushes,
And he sang the song of children,
Sang the song Nokomis taught him:
"Wah-wah-taysee, little fire-fly,
Little, flitting, white-fire insect,
Little, dancing, white-fire creature,
Light me with your little candle,
Ere upon my bed I lay me,
Ere in sleep I close my eyelids!"
  Saw the moon rise from the water
Rippling, rounding from the water,
Saw the flecks and shadows on it,
Whispered, "What is that, Nokomis?"
And the good Nokomis answered:
"Once a warrior, very angry,
Seized his grandmother, and threw her
Up into the sky at midnight;
Right against the moon he threw her;
'Tis her body that you see there."
  Saw the rainbow in the heaven,
In the eastern sky, the rainbow,
Whispered, "What is that, Nokomis?"
And the good Nokomis answered:
"'Tis the heaven of flowers you see there;
All the wild-flowers of the forest,
All the lilies of the prairie,
When on earth they fade and perish,
Blossom in that heaven above us."
  When he heard the owls at midnight,
Hooting, laughing in the forest,
"What is that?" he cried in terror,
"What is that?" he said, "Nokomis?"
And the good Nokomis answered:
"That is but the owl and owlet,
Talking in their native language,
Talking, scolding at each other."

. . . .

  Then Iagoo, the great boaster,
He the marvelous story-teller,
He the traveler and the talker,
He the friend of old Nokomis,
Made a bow for Hiawatha;
From a branch of ash he made it,
From an oak-bough made the arrows,

Tipped with flint, and winged with feathers,
And the cord he made of deer-skin.
Then he said to Hiawatha:
"Go, my son, into the forest,
Where the red deer herd together,
Kill for us a famous roebuck,
Kill for us a deer with antlers!"
 Forth into the forest straightway
All alone walked Hiawatha
Proudly, with his bow and arrows;
And the birds sang round him, o'er him,
"Do not shoot us, Hiawatha!"
Sang the robin, the Opechee,
Sang the blue-bird, the Owaissa,
"Do not shoot us, Hiawatha!"
 Up the oak-tree, close beside him,
Sprang the squirrel, Adjidaumo,
In and out among the branches,
Coughed and chattered from the oak-tree,
Laughed, and said between his laughing,
"Do not shoot me, Hiawatha!"
 And the rabbit from his pathway
Leaped aside, and at a distance
Sat erect upon his haunches,
Half in fear and half in frolic,
Saying to the little hunter,
"Do not shoot me, Hiawatha!"
 But he heeded not, nor heard them,
For his thoughts were with the red deer;
On their tracks his eyes were fastened,
Leading downward to the river,
To the ford across the river,
And as one in slumber walked he.
 Hidden in the alder-bushes,
There he waited till the deer came,
Till he saw two antlers lifted,
Saw two eyes look from the thicket,
Saw two nostrils point to windward,
And a deer came down the pathway,
Flecked with leafy light and shadow.
And his heart within him fluttered,
Trembled like the leaves above him,
Like the birch-leaf palpitated,
As the deer came down the pathway.
 Then, upon one knee uprising,
Hiawatha aimed an arrow;
Scarce a twig moved with his motion,
Scarce a leaf was stirred or rustled,
But the wary roebuck started,
Stamped with all his hoofs together,
Listened with one foot uplifted,
Leaped as if to meet the arrow;
Ah! the singing, fatal arrow,
Like a wasp it buzzed and stung him!
 Dead he lay there in the forest,
By the ford across the river;
Beat his timid heart no longer,
But the heart of Hiawatha
Throbbed and shouted and exulted,
As he bore the red deer homeward,
And Iagoo and Nokomis
Hailed his coming with applauses.
 From the red deer's hide Nokomis
Made a cloak for Hiawatha,
From the red deer's flesh Nokomis
Made a banquet in his honor.
All the village came and feasted,
All the guests praised Hiawatha,
Called him Strong-Heart, Soan-ge-taha!
Called him Loon-Heart, Mahn-go-taysee!

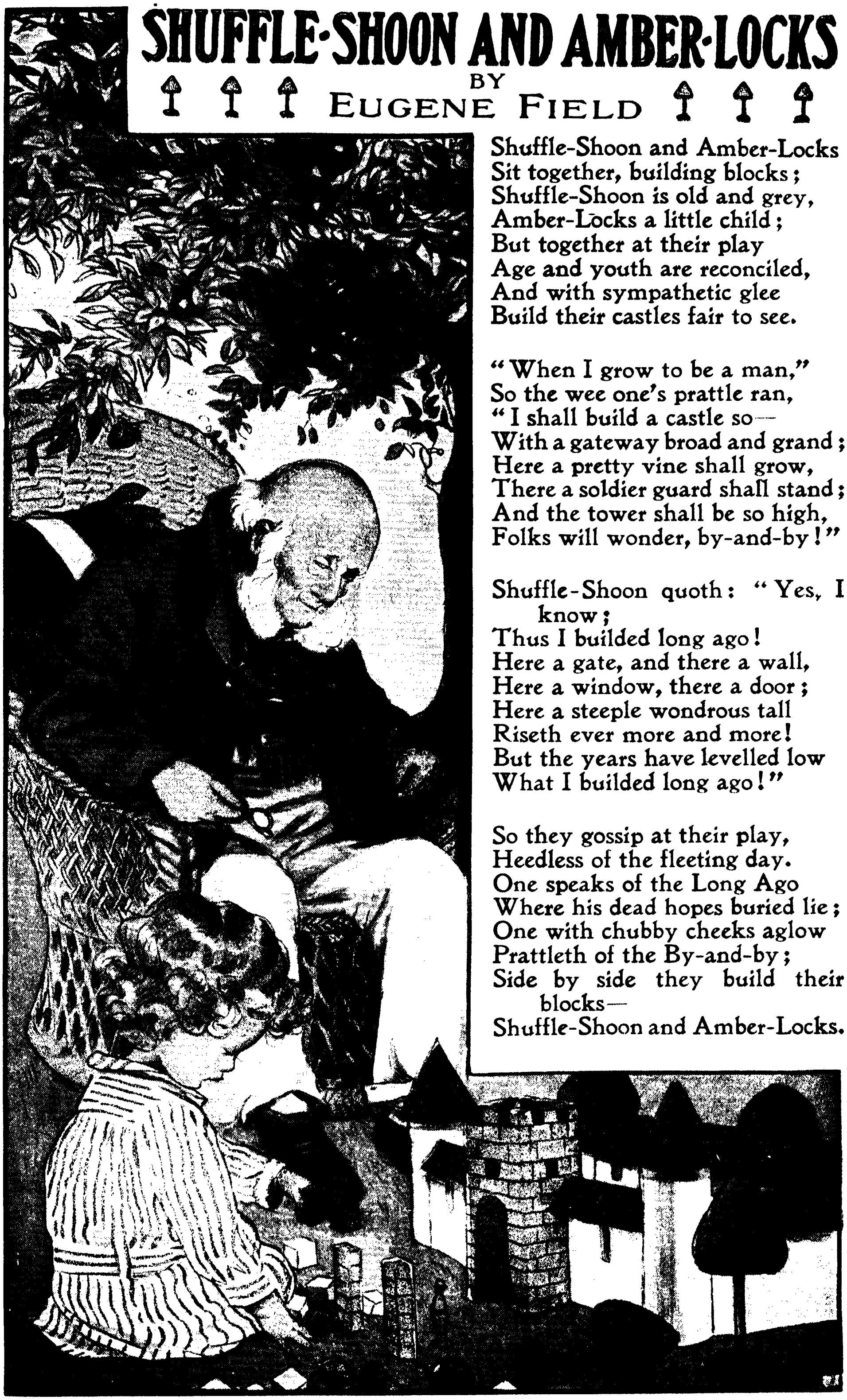
HIAWATHA'S DEPARTURE

 Slowly o'er the simmering landscape
Fell the evening's dusk and coolness,
And the long and level sunbeams
Shot their spears into the forest,
Breaking through its shields of shadow,
Rushed into each secret ambush,
Searched each thicket, dingle, hollow;
Still the guests of Hiawatha
Slumbered in the silent wigwam.
 From his place rose Hiawatha,
Bade farewell to old Nokomis,
Spake in whispers, spake in this wise,
Did not wake the guests, that slumbered:
 "I am going, O Nokomis,
On a long and distant journey,
To the portals of the Sunset,
To the regions of the home-wind,
Of the Northwest wind, Keewaydin.
But these guests I leave behind me,
In your watch and ward I leave them;
See that never harm comes near them,
See that never fear molests them,
Never danger nor suspicion,
Never want of food or shelter,
In the lodge of Hiawatha!"
 Forth into the village went he,
Bade farewell to all the warriors,
Bade farewell to all the young men,
Spake persuading, spake in this wise:
 "I am going, O my people,
On a long and distant journey;
Many moons and many winters
Will have come, and will have vanished,
Ere I come again to see you.
But my guests I leave behind me;
Listen to their words of wisdom,
Listen to the truth they tell you,
For the Master of Life has sent them
From the land of light and morning!"
 On the shore stood Hiawatha,
Turned and waved his hand at parting;
On the clear and luminous water
Launched his birch canoe for sailing,
From the pebbles of the margin
Shoved it forth into the water;
Whispered to it, "Westward! Westward!"
And with speed it darted forward.
 And the evening sun descending
Set the clouds on fire with redness,
Burned the broad sky, like a prairie,
Left upon the level water
One long track and trail of splendor
Down whose stream, as down a river,
Westward, westward Hiawatha
Sailed into the fiery sunset,
Sailed into the purple vapors,
Sailed into the dusk of evening.
 And the people from the margin
Watched him floating, rising, sinking,
Till the birch canoe seemed lifted
High into that sea of splendor,
Till it sank into the vapors
Like the new moon slowly, slowly
Sinking in the purple distance.

SHUFFLE-SHOON AND AMBER-LOCKS

BY

EUGENE FIELD



Shuffle-Shoon and Amber-Locks
Sit together, building blocks;
Shuffle-Shoon is old and grey,
Amber-Locks a little child;
But together at their play
Age and youth are reconciled,
And with sympathetic glee
Build their castles fair to see.

"When I grow to be a man,"
So the wee one's prattle ran,
"I shall build a castle so—
With a gateway broad and grand;
Here a pretty vine shall grow,
There a soldier guard shall stand;
And the tower shall be so high,
Folks will wonder, by-and-by!"

Shuffle-Shoon quoth: "Yes, I know;
Thus I builded long ago!
Here a gate, and there a wall,
Here a window, there a door;
Here a steeple wondrous tall
Riseth ever more and more!
But the years have levelled low
What I builded long ago!"

So they gossip at their play,
Heedless of the fleeting day.
One speaks of the Long Ago
Where his dead hopes buried lie;
One with chubby cheeks aglow
Prattleth of the By-and-by;
Side by side they build their blocks—
Shuffle-Shoon and Amber-Locks.

DOCTOR FAUSTUS was a good man,
He whipped his scholars now and then.
When he whipped them he made them dance,
Out of Scotland into France,
Out of France into Spain,
And then he whipped them back again!

JOHN COOK had a little grey mare; he, haw, hum!
Her back stood up, and her bones they were bare; he, haw, hum!

John Cook was riding up Shunter's bank; he, haw, hum!
And there his nag did kick and prank; he, haw, hum!

John Cook was riding up Shunter's Hill; he, haw, hum!
His mare fell down, and she made her will; he, haw, hum!

The bridle and saddle were laid on the shelf; he, haw, hum!
If you want any more you may sing it yourself; he, haw, hum!

I DO not like thee, Doctor Fell;
The reason why I cannot tell.
But this I know, and know full well,
I do not like thee, Doctor Fell.

"WE are three brethren out of Spain,
Come to court your daughter Jane."
"My daughter Jane she is too young;
She has no skill in a flattering tongue."

"Be she young, or be she old,
It's for her gold she must be sold;
So fare you well, my lady gay,
We'll call again another day."

"Turn back, turn back, thou scornful knight,
And rub thy spurs till they be bright."
"Of my spurs take you no thought,
For in this land they were not bought.
So fare you well, my lady gay,
We'll call again another day."

"Turn back, turn back, thou scornful knight,
And take the fairest in your sight."
"The fairest maid that I can see
Is pretty Nancy. Come to me!"

IF you are to be a gentleman, as I suppose you be,
You'll neither laugh nor smile for a tickling of the knee.

BUTTONS, a farthing a pair,
Come, who will buy them of me?
They're round and sound and pretty,
And fit for the girls of the city.
Come, who will buy them of me,
Buttons, a farthing a pair?

MASTER I have, and I am his man,
Gallop a dreary dun;
Master I have, and I am his man,
And I'll get a wife as fast as I can;
With a heighty gaily gamberally,
Higgledy, piggledy, niggledy, niggledy,
Gallop a dreary dun.

ROCK-A-BY, baby, thy cradle is green;
Father's a nobleman, mother's a queen;
And Betty's a lady, and wears a gold ring;
And Johnny's a drummer, and drums for the king.

TWO Robin Redbreasts built their nest
Within a hollow tree;
The hen sat quietly at home,
The cock sang merrily;
And all the little ones said:
"Wee, wee, wee, wee, wee, wee."

One day the sun was warm and bright,
And shining in the sky,
Cock Robin said: "My little dears,
'Tis time you learned to fly."
And all the little young ones said:
"I'll try, I'll try, I'll try."

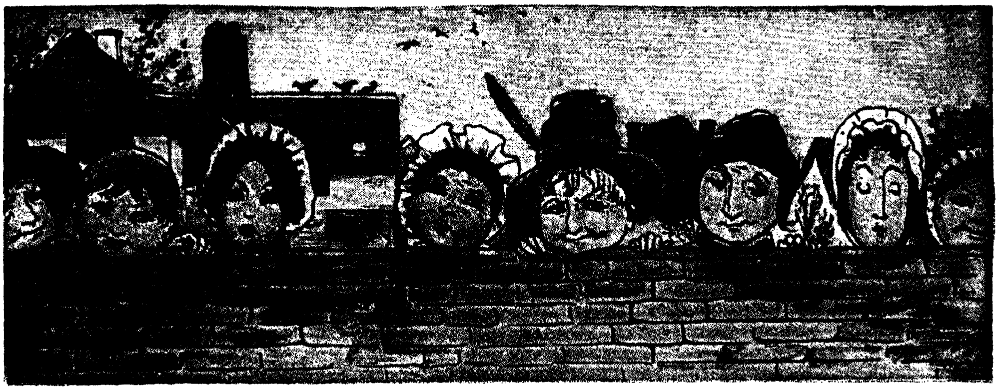
I know a child, and who she is
I'll tell you by and by,
When Mamma says "Do this," or "that,"
She says "What for?" and "Why?"
She'd be a better child by far
If she would say "I'll try."

UPON St. Paul's steeple stands a tree,
As full of apples as may be;
The little boys of London Town,
They run with hooks and pull them down;
And then they run from hedge to hedge,
Until they come to London Bridge.

AROUND the green gravel the grass grows green,
And all the pretty maids are plain to be seen;
Wash them with milk, and clothe them with silk,
And write their names with a pen and ink.

CUSHY cow, bonny, let down thy milk,
And I will give thee a gown of silk;
A gown of silk and a silver tee,
If thou wilt let down thy milk to me.

THERE was a little man,
And he had a little gun,
And his bullets were made of lead, lead, lead;
He shot Johnny King
Through the middle of his wig,
And knocked it right off his head, head, head.



THE PEN AND PENCIL OF KATE GREENAWAY

ALTHOUGH so many ladies have devoted themselves to the dainty art of illustrating and writing children's books, perhaps Kate Greenaway, who was born in 1846 and died in 1901, is the only one who became famous all the world over in this way. She was the daughter of a London wood-engraver, and studied art from her earliest years. There is such a charm and freshness about all her little drawings, and so quiet a touch of humor, that both old and young find them full of entertainment. Her simple verses are of less importance than her delightful illustrations, but they are tuneful and appropriate. A selection from her sketches and verses is given on these two pages and elsewhere by permission of the publishers, Messrs. Frederick Warne and Company.

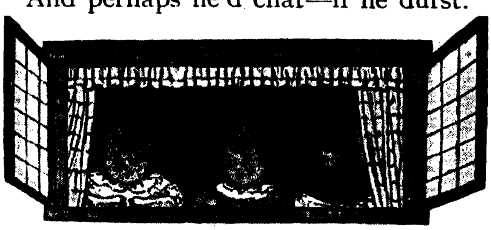
LOOK over the wall, and I'll tell you why
The King and the Queen will soon pass by.
Madams and masters, look this way;
The King and his Court ride past to-day.

The Queen has a robe that is gold and red;
She is stately, and sits with a crown on her head;
And four very little boys after her go,
To do as she bids them—they never say "No."

The banners are waving, the soldiers are drumming;
'Tis indeed a fine sight that, I tell you, is coming
So, if you look long enough over the wall,
You'll see a great deal, if you do not see all.

UNDER the window is my garden,
Where sweet, sweet flowers grow;
And in the pear-tree dwells a robin,
The dearest bird I know.

Tho' I peep out betimes in the morning,
Still the flowers are up the first;
Then I try and talk to the robin,
And perhaps he'd chat—if he durst.



PRINCE FINIKIN and his mamma
Sat sipping their bohea;
"Good gracious!" said his Highness, "why,
What girl is this I see?

"Most certainly it cannot be
A native of our town."
And he turned him round to his mamma,
Who set her teacup down.

But Dolly simply looked at them;
She did not speak a word.
"She has no voice," said Finikin;
"It's really quite absurd."

Then Finikin's mamma observed,
"Dear Prince, it seems to me,
She looks as if she'd like to drink
A cup of my bohea."

So Finikin poured out her tea,
And gave her currant-pie.
Then Finikin said: "Dear mamma,
What a kind Prince am I!"

THREE little girls were sitting on a
Sitting on a rail, [rail,
Sitting on a rail ;
Three little girls were sitting on a rail,
On a fine hot day in September.

What did they talk about that fine day,
That fine day,
That fine day ?
What did they talk about that fine day,
That fine hot day in September ?

The crows and the corn they talked
about,
Talked about,
Talked about ;
But nobody knows what was said by the
crows,
On that fine hot day in September.

FIVE little sisters walking in a row ;
Now, isn't that the best way for
little girls to go ?
Each had a round hat, each had a muff,
And each had a new pelisse of soft green
stuff.

Five little marigolds standing in a row ;
Now, isn't that the best way for mari-
golds to grow ?
Each with a green stalk, and all the five
had got
A bright yellow flower and a new red
pot.

POLLY'S, Peg's, and Poppety's
Mamma was kind and good ;
She gave them each, one happy day,
A little scarf and hood.

A bonnet for each girl she bought,
To shield them from the sun ;
They wore them in the snow and rain,
And thought it mighty fun.

But sometimes there were naughty
boys,
Who called to them at play,
And made this rude remark : " My
eye !
Three Grannies out to-day ! "

LITTLE Miss Patty and Master Paul
Have found two snails on the
garden wall.
" These snails," said Paul, " how slow
they walk !
A great deal slower than we can talk.
Make haste, Mr. Snail, travel quicker, I
pray ;
In a race with our tongues you'd be
beaten to-day."

THREE tabbies took out their cats to
tea,
As well-behaved tabbies as well could be ;
Each sat in the chair that each pre-
ferred,
They mewed for their milk, and they
sipped and purred.
Now, tell me this, as these cats you've
seen them—
How many lives had these cats between
them ?

THE WHITE HART

Words by ALFRED P. GRAVES. Music by permission of MESSRS. SCHOTT & Co.

THE MILLER AND HIS PETS

CONTINUED FROM 3711

A LONG time ago a band of robbers settled in a hut on a lonely heath. They waylaid travelers and took their money, and broke into farmhouses and robbed the farmers. One afternoon, when the old miller who lived in the windmill on the edge of the heath had gone to town, the robbers entered his rooms, stole all his savings, and set fire to the mill.

The old miller returned in the evening and found that he was ruined. But what grieved him most of all was that the robbers had stolen all his provisions. He did not mind going without a meal himself, but there was no food for his donkey, his dog, his cat, and the two ducks. Being a lonely man, he had made great pets of all his animals. He loved them very dearly, and, rather than see them starve, he resolved to set them free. So he said to them :

" You see the robbers have taken everything. There is no hay for the donkey, no meat for the dog, no milk for the cat, no grain for the ducks. I can't keep you here, my pets, and let you die for want of food. Go out together, and see if you can't pick up something to eat on the heath."

All the animals were very sad at leaving their master, and they wandered about looking for food and lodging. At last they came to the hut where the robbers were sitting at a table eating their supper by the dim light of a tallow candle.

" Here's a chance to get a good shelter for the night," said the dog. " Crouch down in the bushes, all of you, and make as much noise as you can. See if we can't frighten these thieves out of their senses."

The animals hid themselves in the brushwood around the hut, and began to make a fearful racket.

" Hee-haw, hee-haw ! " bellowed the donkey, with a voice like thunder.

" Mee-ow-u-ou ! " shrieked the cat.

" Bow-wow-grrr ! " roared the dog.

" Qua, qua, qua ! " squawked the ducks.

The robbers were greatly frightened by the strange uproar ; and when one of the ducks flew in and knocked the candle over and left the hut in darkness, the men were terror-stricken, and they rushed out and fled wildly in all directions.

The animals then joyfully entered the hut, and made a good meal out of the robbers' supper, and then laid down to sleep. The donkey slept by the door, the dog underneath the table, the cat above it, and the two ducks on the top of the open door.

When the robbers recovered from their fright, their captain determined to see what had happened at the hut. He went back, and, finding the

place very dark and silent, he crept through the open door, but with the noise the animals at once awoke.

The dog sprang out and bit his leg. Then, as he passed the table, the cat jumped up and scratched his face. The two ducks spread out their wings and flapped about his head, and when at last he staggered to the door, the donkey gave him a terrific kick, and sent him flying into a prickly bramble bush. The robber captain crawled away, and told his men that a murderous gang had captured their hut, and would kill them if they went back.

"One of them," he said, "stabbed me in the leg. Another just managed to graze my face with his knife. Three or four of them flapped a cloth about my head and tried to wrap it round me and stifle me. And just as I thought I had got safely away, someone struck me in the back with a great sledge-hammer, and very nearly killed me."

"We'd better leave this neighborhood at once," said his men.

They hurried away, more frightened than ever, and never did they return to the heath.

In the morning, the dog noticed that the ground had been disturbed in a corner of the hut. Scratching up the earth, he found a large sack full of money. This the donkey managed to hoist on his back, and the dog and the cat and the two ducks proudly marched by his side across the heath to the ruined mill. With the money that the animals brought to him, the old miller repaired and stocked his mill, and there he lived happily and quietly with all his pets, and often amused himself over the story of the capture of the robbers' treasure.

A SON OF A GUN

SCREWWORM sat down amongst the toadstools and opened the book which is called "Gnome Gnobodies." In America we have a book called "Who's Who." It tells us about famous people. In fairyland they have "Gnome Gnobodies," which is just the opposite.

In "Gnome Gnobodies" the gnomes read about gnomes who are not famous.

Screwworm opened his enchanting book at the letter T, and turned the pages till he came to the name Tompin. This is what he read:

"Tompin is a duffer, and flighty. He was born on the planet Mars in the year 12, and emigrated to the earth in the year 1066. As he was neither woman nor man, he attached himself to the Normans and followed them to England. His favorite recreation is stroking his chin. He neither reads nor writes. He earns his living by doing nothing. His favorite residence is the muzzle of naval guns, which he prefers to old-fashioned clubs. He can swim backward as well as forward. His present address is U.S. Dreadnought, At Sea."

When Screwworm had read this account of Tompin, he said: "That's the little fellow for my money The very thing."

Something stirred at his side. He looked up, and saw the Lizard.

"Good-evening," said Screwworm.

"Certainly," answered the Lizard.

"How did you find Landsend?"

"Rocky," replied the Lizard.

"Now listen to me," said Screwworm, resting his arm on a toadstool and regarding the Lizard over his glasses. "Do you, or do you not, know Tompin?"

"I've seen him," answered the Lizard, "but I can't say that I know him. We don't speak. He's a son of a gun."

"Quite so. Now, I've invented a gun myself; it's a beauty. It fires sea-shells on the seashore. The shells are sells; that is to say, the sea-shells it sells are seashore sells. Not Wilkie's, for those are Bard—but Winkle's! Do you follow?"

"You mean to say, your gun fires winkle-shells which are sells; that is to say, they are not genuine. You are using slang?"

"You have me. I use slanguage for this reason—the mouth of my gun likes it. If you want to make a hit nowadays, you must use slang. I want to make a hit. Do you know what I want to hit?"

"Hush!" whispered the Lizard. "He's here!"

Screwworm turned his head. Tompin was regarding him over a toadstool.

"Good-evening, monsieur. Do you speak German?" asked Screwworm.

Tompin said nothing. His old face had a set smile, which was neither merry nor pleasant. You might have called it a blind smile, or even a dumb smile.

SOMETHING STIRRED AT SCREWWORM'S SIDE, AND, LOOKING UP, HE SAW THE LIZARD

" Don't you speak at all ? " demanded Screwworm, frowning.

After waiting a long time for an answer, Screwworm got up, laid " Gnome Gnobodies " on the ground, and, walking over to Tompin, said : " Come hither, little bird ! " Very gently he took the left ear of the old fellow between his finger and thumb and led him away.

" Monsieur," said he, " I have a gun."

Tompin stopped dead. His face quite lighted up.

" What's the matter ? " asked Screwworm.

" I am saved," said Tompin—" if it's at all fatherly."

" Explain yourself."

" The Navy," said Tompin, " is practising gun-fire just now. There is not a single gun that is safe for me to sit in. The consequence is——"

" Yes."

" I am an orphan, a waif, a homeless and fatherless wretch. It is immensely sad."

" You are welcome to sit in my gun. It shall adopt you."

" It won't go off—and leave me ? "

" I shouldn't think so."

" Oh, thanks ! For this relief, much thanks. Get you to a gunnery, as Shakespeare says. I'm your boy. Let us fly to it."

They continued their way. When they came to Screwworm's gun, the face of Tompin became very green.

" It smells fishy ! " he said suspiciously.

" Try it," said Screwworm.

" I don't like the smell," muttered Tompin, poking his nose in the muzzle and sniffing deeply. " It suggests sea-shells. Too much mussel to be strong. I fear I might be oystered. If you will allow me, I will limpet."

He started to go on, but Screwworm caught him by the ear again, and said :

" Try it, poor orphan."

" You are sure you don't mind ? " asked Tompin.

" Tut ! "

" Here goes, then ! " cried Tompin ; and he jumped into the muzzle of Screwworm's gun.

Quick as lightning Screwworm ran to the back of it, struck a match, and applied it to the touch-hole.

A bright flame shot into the air.

Something went *fiz-z-z-z-z* ! And then there was a tremendous explosion.

The air for miles became black with winkle-shells.

Thousands and thousands of gnomes came rushing up from all directions. They found the gun lying on the ground, smoking hot, and emitting yellow and green flames. Screwworm and Tompin were nowhere to be seen.

Scramblepipe, who was among the company, exclaimed :

" Something has happened ! "

At that moment the Lizard appeared in the midst of the group.

" My dear friends," said he, " if you will be patient for a few moments, you will see a sight worth seeing. Let me explain. This gun is so perfectly balanced that the pace of the discharge is equal to the pace of the recoil. The force is exactly equal to the circumference of the earth. Now, what has happened ? Tompin from the muzzle of the gun and Screwworm from the breech of the gun are now at this moment going round the world. Do you follow me ? If you wait a moment, you will see what I mean."

Scarcely had the Lizard ceased speaking when Tompin from the east and Screwworm from the west appeared in the air, rushing towards each other at a pace so furious that all the gnomes instantly rushed for shelter under the toadstools.

" They passed each other half-way round the world," said the Lizard. " Now you will meet and embrace. Bang ! "

At that minute the two bodies came together with a whack ! Then they fell straight to the earth in each other's arms.

" Did you enjoy it ? " asked Screwworm breathlessly.

" You have impressed me," said Tompin, with sincere admiration.

For a moment he regarded the gun, still smoking on the ground ; then, with a rush of tears to his eyes, and quite overcome with emotion, he fell upon one knee, laid his arms lovingly about the gun, and, pressing his cheek against it, exclaimed :

" Papa, papa, I have come back to you ! "

The Lizard turned to Screwworm, and said :

" Let us leave him where he is. The poor orphan is now at peace."

LITTLE STORIES ABOUT FLOWERS

Almost every flower has a story, just as almost every place has a legend, and many flowers have many stories. They are "made-up," perhaps, as the legends are, but they are often very beautiful, and it is interesting to know the stories that have been told for hundreds of years about the flowers that bloom in our gardens still.

THE PANSY

THE charming name which many little English country maidens have given to the pansy is Three-Pretty-Faces-Under-One-Hood. The little French country maidens, however, called it Trinity Herb. At first, they say, the pansy had a sweeter and more delicious scent than its little sister, the March violet. It grew in the wheat fields, and it was much beloved because of its union of beautiful colors and exquisite fragrance, and everybody used to trample down the wheat to get it.

The result was, that when harvest-time came there was no food for the people. This grieved Three-Pretty-Faces-Under-One-Hood, and one spring-time she prayed to the Trinity that she might be deprived of her sweet scent, so that nobody would destroy the growing wheat for her sake. Her prayer was granted, and her perfume taken away. From that time Three-Pretty-Faces-Under-One-Hood has been called Trinity Herb by the little French country maids.

THE FORGET-ME-NOT

IN the morning of the world, an angel was sent on an errand to a holy man dwelling in a desert in Persia. But as the angel was flying through the air he saw a beautiful Persian girl sitting by a well-side, and braiding her lovely hair with blue forget-me-nots. He came down and made love to her, and for a while they lived very happily together. Suddenly the angel remembered that he had not delivered his message. He flew back to heaven to ask pardon, but he found that the gate of heaven was closed to him. For a long time he stood by the closed gate weeping, and then the Archangel Gabriel appeared, and said:

"It is ordered that you must people the earth with the Children of the Sky before you can bring a daughter of the earth into heaven."

The angel did not understand what this meant, and asked his beautiful bride if she could explain it.

"Yes," she replied, taking some of the flowers from her hair. "These lovely blue forget-me-nots, which reflect the exquisite color of heaven, are the Children of the Sky."

So the angel and his bride wandered hand in hand over the earth, and planted forget-me-nots in every country. Then, when their task was ended, the angel took his bride in his arms, and carried her up to the gate of heaven.

THE ROSE

IN the days of the ancient gods, there lived in the Greek town of Corinth a lady whose name was Rhodanthe. Rhodanthe was ravishly beautiful, and her house was besieged by kings and lords, who were eager to win her love.

In order to escape from the throng of her lovers, Rhodanthe fled for refuge into the temple of the white and lovely goddess of purity, Artemis. But her lovers followed her, and the people of Corinth helped them to break open the gates of the sacred temple. Artemis was angered by the outrage, and she changed Rhodanthe into the red rose, which is still deeply colored with the blush which spread on Rhodanthe's cheeks when her beautiful face was exposed to the gaze of her lovers. The breakers of the temple, on the other hand, were changed into the thorns which now guard the loveliness of Rhodanthe.

THE ANEMONE

THERE was once a Spirit of the Flowers whose name was Chloris, and the Spirit of the West Wind used to come into her garden and make love to her. The Spirit of the Flowers had many pretty nymphs in her garden, and among them was a little maiden who was called Anemone.

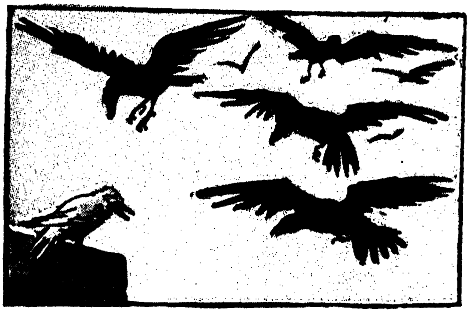
One day the Spirit of the West Wind turned away from Chloris and began to make love to Anemone. This made Chloris very angry, and she drove Anemone out her garden, and left her to perish in the wild woods.

Happily, the Spirit of the West Wind passed through the woods, and he found Anemone, just as she was dying, and turned her into the little, white, tender, and graceful flower which now grows beneath the trees in early spring.

FABLES OF ÆSOP THE SLAVE

THE JACKDAW AND THE PIGEONS

A JACKDAW who noticed that the pigeons in a certain dovecot were very well fed, whitewashed his feathers



in order to look as much like a dove as possible, and went and lived among them. The pigeons, so long as he kept silent, did not recognize him; but at last he forgot that he was acting the part of a dove, and began to chatter like a jackdaw.

Then the pigeons saw what he was, and drove him away. But when he flew back to the church tower, the other jackdaws, not knowing him in his discolored feathers, also drove him away, so that he had no home to go to.

It is no use pretending to be what we are not, for we are sure to be found out sooner or later.

THE THIEF AND THE DOG

A THIEF came to rob a certain house one night, but was disturbed by a fierce dog, which kept continually barking at him.

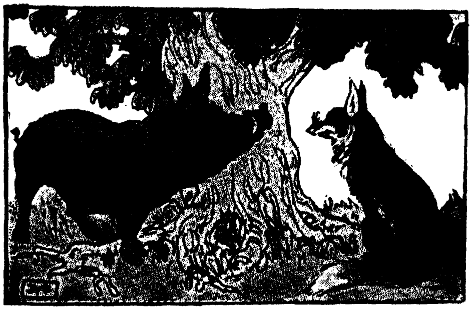
The thief, thinking to stop his mouth, threw him a piece of meat. The dog

refused it with indignation, telling him that before he only suspected him to be a bad man, but now that he had tried to bribe him he was certain of it. He added that the care of his master's house was entrusted to him, and he should never stop barking while such a man was about.

When anyone offers us a present not to tell, we may be sure that there is something wrong.

THE FOX AND THE BOAR

A BOAR was one day sharpening his tusks against the trunk of a tree. A fox who happened to be passing at the same time asked why he was making



these warlike preparations when there was no enemy near.

The boar answered: "That is quite true, Mr. Fox; but we should always sharpen our weapons while we have leisure, for in time of danger we shall have something else to do."

Never be idle. We can always find something to do.

THE GOOSE WITH THE GOLDEN EGGS

A MAN once had a goose which laid a golden egg every day; but he was so greedy that he was not content with this, and so he killed the goose and cut her open, thinking that he would find

enormous riches inside her. But, to his great disappointment, he found nothing; and after the goose was killed, of course, no more golden eggs were laid.

We gain nothing by being greedy.

THE ANGLER AND THE LITTLE FISH

A MAN was angling in a river and caught a very small perch. As he was taking out the hook, and going to put the fish into his basket, it opened its mouth and began to beg for pity, and to ask that he would throw it into the river again.

The man asked why he should do so. The fish answered :

" Because at present I am so very young and small and not worth much ; but if you throw me back into the river you may be able to catch me at some

future time when I have grown much larger." But the man answered that he was not so silly as to throw away a little fish when he was not at all sure of catching him when he had got big.

A bird in the hand is worth two in the bush.

THE ASS IN THE LION'S SKIN

A DONKEY chanced one day to find the skin of a lion, and put it on. Then he went into the woods and fields and frightened all the flocks and herds. At last the donkey met his owner and tried to frighten him, too ; but the man, noticing the long ears of the donkey, at

once recognized what animal he really was, and gave him a sound beating with a thick stick.

It is of no use to pretend to be greater or cleverer than we are.

THE WIND AND THE SUN

ONE day the north wind and the sun were having an argument as to which was the stronger, and they agreed to try their strength upon a traveler. The one that got the traveler's cloak off

first was to be the winner. The north wind began, and blew a strong, cold blast, accompanied by a sharp, driving shower of rain. But instead of blowing the man's cloak off, it only made him hold it round his body all the more closely.

The sun's turn came next, and he began to shine as hot as possible upon the head of the poor weather-beaten traveler. The man grew faint with the heat and unable to bear it any longer, so he threw off his heavy cloak and took shelter in a neighboring wood. Thus the sun was the winner.

Gentle persuasion often succeeds where force fails.

THE WOMAN AND THE EMPTY CASK

AN old woman saw an empty cask lying on the ground from which the wine had just been emptied. She put her nose to the bung-hole and sniffed for some time at the cask, which still smelt pleasantly of the wine. Then she

exclaimed : " Oh, what a delicious smell ! How good the contents must have been when even the cask smells so nice ! "

Good actions, like sweet wine, leave pleasant memories behind them.

AMY ROBSART

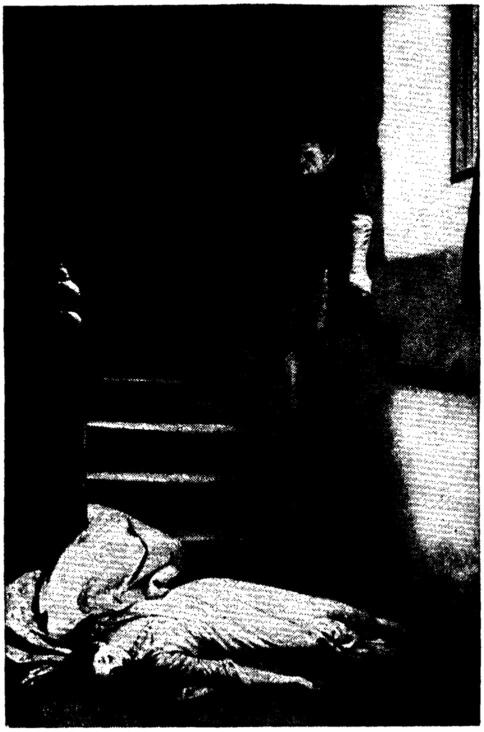
SORE and sad that lady grieved
 In Cumnor Hall, so lone, so drear;
Full many a piercing scream was heard,
 And many a cry of morbid fear.
The death-bell thrice was heard to ring,
 An aerial voice was heard to call;
And thrice the raven flapped its wing
 Around the tower of Cumnor Hall.

And in that manor now no more
 Is cheerful feast and sprightly ball;
For ever since that dreary hour
 Have spirits haunted Cumnor Hall.
The village maids, with fearful glance,
 Avoid the ancient moss-grown wall;
Nor ever lead the sprightly dance
 Among the grass of Cumnor Hall.

WHO was this lady who grieved in Cumnor Hall, and for whom "the death-bell thrice was heard to ring"? She was the daughter of an English gentleman who owned great estates in Cornwall, a certain Sir John Robsart, a man of ancient family and great wealth. She was the heiress of this rich landowner, and rumor says that she was very beautiful.

We can imagine how happy was the childhood of little Amy Robsart in her Cornish home. With a father who adored her, peasants who smiled to see the little lady pass, and a beautiful home, life must have seemed to her a gift expressly made for her enjoyment. And later her happiness must have been greater still. For there came to visit her, and to make love to her, one of the most striking men who ever walked the earth. This was a certain Lord Robert Dudley, a youth so handsome and so gracious in manner that he was reckoned the Apollo of that age. He was tall, strongly but gracefully formed, with a countenance that might have been chiseled, so fine were the features, so delicate the lines. He had the soul of a poet for lovely scenery, and the soul of an artist for splendid buildings.

This youth had been sent to Cornwall by his father, an ambitious man, who had arranged with Sir John Robsart that his handsome son should marry the daughter of the rich knight.



AMY ROBSART WAS THROWN DOWNSTAIRS

After a delightful courtship, and while they were still little more than children, on June 4, 1550, at the palace of Sheen, with King Edward VI. present at the brilliant ceremony, Amy Robsart was married to Lord Robert Dudley.

For ten years they lived together, happily at first, but soon with a gradually increasing unrest. Amy began to see that her handsome boy husband was consumed by one overmastering passion—the passion of ambition. He could not be happy with home life. He wanted to be a figure at court—to outshine all others. He wanted to be a power in the state.

After Edward VI. died, and Elizabeth became Queen of England in 1559, Lord Robert Dudley was soon known to be her favorite, and it was rumored that she would marry him if he were free. She continually showered royal favors upon him. He became Knight of the Garter, Baron of Denbigh, and later the Earl of Leicester. He became the chief jewel of her gorgeous court, and nothing seemed beyond the aspirations of the handsome young courtier. And what became of Amy? She was sent by her husband to Cumnor Hall, near Oxford. This was the residence of a gentleman

named Anthony Foster, who was fond of music and gardening, and said to be a worthy and sagacious man. He was something more. He was in the pay of Lord Robert Dudley.

One night, when a man named Sir Richard Varney, also in the pay of Lord Robert Dudley, was alone with his servant in Cumnor Hall, the chamber door of Amy Robsart was burst open; she was strangled, knocked about the head, and thrown down a flight of stairs. The next day the story was told that Lord Dudley's wife had fallen down a flight of steps, and broken her neck.

Such is the sad story of poor Amy Robsart, the heroine of Sir Walter Scott's romance "Kenilworth." But it is doubted by some learned men whether Lord Leicester, as her husband became, was really guilty of her murder. The proofs are not clear. The history is very obscure. Lord Burleigh certainly declared against Queen Elizabeth's marriage to Lord Leicester, when she thought of making him her husband, because that nobleman was "infamed by the death of his wife." The death of Amy Robsart was, of course, a considerable scandal at that time; and many people thought that her ambitious husband was glad to get rid of her.

But Lord Robert Dudley may have been innocent. His friends and dependants, hoping to advance themselves by his increasing glory, may themselves have contrived the diabolical act. "With his wife out of the way," they may have argued, "he will marry the queen, and we shall all be great men." The murder of Amy Robsart, so far as her husband is concerned, remains one of the mysteries that will probably never be solved.

LES OIES QUI GARDAIENT ROME

THE ENGLISH VERSION OF THIS STORY IS GIVEN ON PAGE 576.

ROME était assiégée. Un terrible et nouvel ennemi l'attaquait. Ces hommes venaient du Nord. Ils étaient grands et sauvages, avaient des yeux bleus perçants et de longs cheveux d'or qui brillaient. Ils s'appelaient les Gaulois.

Des batailles sanglantes furent livrées dans la ville et les légions romaines se virent repoussées sans cesse. Les Gaulois étaient non seulement forts, mais audacieux. Ils se jetaient sur les Romains en poussant des cris terribles et déchiraient leurs rangs.

Les pauvres Romains furent finalement obligés de se retirer dans leur dernière forteresse, appelée le Capitole. Ils s'y trouvaient en sûreté, car qui aurait jamais songé à escalader le roc à pic pour franchir les murs puissants du Capitole? Mais c'était terrible et triste pour les soldats romains, bien qu'ils fûssent en sûreté, de voir du haut des murs du fort, les sauvages Gaulois brûlant leurs maisons et s'emparant de tout ce qu'ils possédaient de précieux comme butin.

Les Romains bientôt eurent affreusement faim. Plus d'une fois, ils durent regarder les oies sacrées qui vivaient dans le temple de Junon, en se disant que ce ne serait pas un crime de les tuer pour les manger.

Mais les oies étaient sacrées aux Romains. Les tuer eût été un sacrilège.

Il arriva, une nuit, tandis qu'un jeune Romain, nommé Manlius, était endormi près de son épée non loin du temple de Junon, qu'un bruit étrange troubla ses rêves, l'éveilla subitement et lui fit saisir son épée en se levant rapidement.

Il reconnut le bruit aussitôt. C'était le cri des oies sacrées. Qu'est-ce qui avait réveillé ces oiseaux?

Le bruit augmenta, et devint bientôt une rumeur d'alarme et de panique; tout le troupeau d'oies remplissait la nuit de ses cris de frayeur.

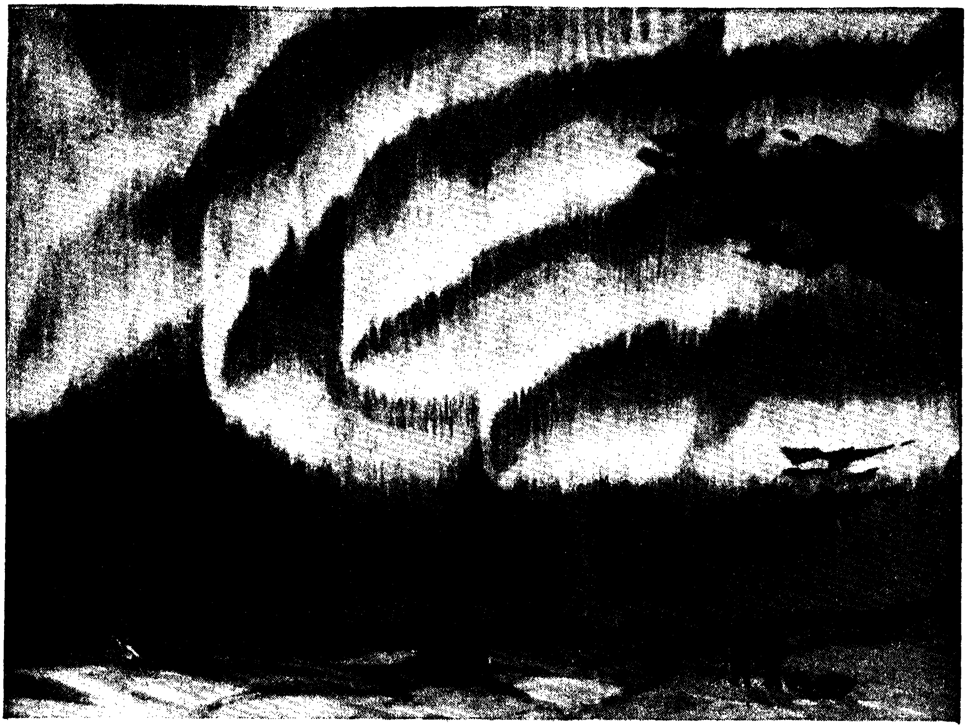
Manlius courut aux murs du fort et se pencha. Il se trouva en face d'un Gaulois!

Le chef des Gaulois avait conduit ses hommes à l'assaut pour une attaque nocturne et il allait se hisser par dessus le mur quand Manlius apparut. Manlius aussitôt saisit les poignets tendus du Gaulois, arracha ses doigts du parapet et lança son ennemi à bas de la colline.

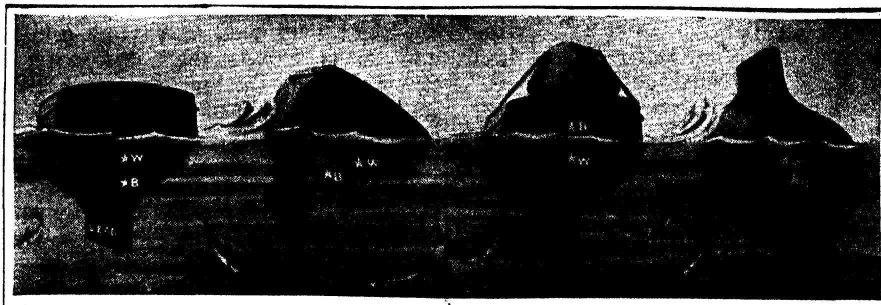
Le crit d'alarme des oies devint de plus en plus perçant. Des Romains furent éveillés en sursaut, et, saisissant leurs armes, ils se hâtèrent d'aller voir ce qui se passait. Ils trouvèrent Manlius qui défendait les murs. Avec un cri de victoire, ils s'élancèrent à son secours et en quelques minutes, toute la garnison fût éveillée; les Gaulois furent repoussés et complètement battus.

THE NEXT STORIES ARE ON PAGE 4049.

THE GLORY OF THE POLAR LIGHTS



During the long Arctic and Antarctic night when the sun is hidden for months, the gloom and darkness of these regions are lit up by brilliant displays of the Aurora Polaris, or polar lights. This exhibition of light and color, one of the most magnificent electrical displays in all Nature, takes various forms. The lights were called Aurora Borealis or northern lights until it was found that they appear also in the Antarctic regions.



A boat must be weighted at the bottom to lower its centre of gravity, B, below the point W, the centre of gravity of the water the boat displaces. The boat will then rock, but not capsize. If, by putting a weight on deck the centre of gravity rises to B, above W, then the boat easily capsizes.

THE PULL OF THE EARTH

CONTINUED FROM 3829

THERE is a term connected with gravity which we must understand, and which we shall find will throw light on what we have already learned about equilibrium; this is the term *centre of gravity*. In the case of any object there must be, as we can imagine, a point around which the whole of it could be balanced. The amount of matter in the body would be so disposed all round that point that if it were hung by a thread at that point it would stay at that position. It would balance perfectly around that point. It is as if all the matter of the body were really massed together at that point, which we call its centre of gravity. Probably, a better term would be *centre of mass*.

If we have a round ball made throughout of the same material, the centre of the ball will be its centre of gravity. Now, suppose we take a square board with the intention of finding its centre of gravity, assuming, of course, that the board is made of the same material and is of the same thickness throughout. We want to fix a single thread to the board at one point, so that the thread will support the board evenly. That point will, of course, be the centre of gravity.

Now, we all know what a diagonal is—the line joining opposite corners of such a board. If we draw the two diagonals, the point where they cross each other is the centre of gravity. That is all very well, but it is not quite so easy to find the centre of gravity of a body that has an irregular shape. Suppose, for instance, that, instead of a square board or a round one, we had one of a quite irregular shape, and wished to find the point at which we could support it so that it would lie evenly. Let us pick up the board, tie a string somewhere to its edge, and let it hang steady. If we draw a line straight down the board continuing the line of the string, the centre of gravity will be somewhere in that line. Now, it is a very interesting fact that we should be able to say this for certain, and we must try to understand why we can do so. When the board hangs steady from the string, there must be, as in any other case of equilibrium, a balance of forces.

These forces, of course, are the earth's gravity pulling downwards and the tension of the string pulling upwards. Now, as these two forces act equaly and oppositely, the centre of gravity must be somewhere in the line of them, just as if the whole substance of the board were at that point. If the centre of gravity were to one side of the line of the string, then we should have what is called a *couple* of forces. Gravity

and the pull of the string would be acting not in the same straight line, but oppositely, in parallel lines, and this couple would mean that the board was twisted until the centre of gravity *did* come to lie under the string. The only real way to understand this—which is perfectly simple—is to draw a diagram for ourselves as we read it. First, we can draw a diagram showing what really happens, then we can draw a diagram showing the board with the centre of gravity to one side of the line downwards from the string, and then we can see how the couple of forces is bound to rotate the board, or turn it round.

HOW WE MAY FIND THE CENTRE OF GRAVITY OF A BOARD OR A PLATE

Now, we laid down no condition as to the point from which the board was to be hung. No matter from where it is hung, what we say is true. Suppose, then, that we hang it up again from some second point, and then draw the line downwards from the string, the centre of gravity will be somewhere in that line, as we said before; but we know that it is also somewhere in the first line we drew. Now, there is only one point which is common to both lines, and that is the point where they cross each other. The centre of gravity of the board is there. If we have made our experiment precisely, and if we can attach a wire or a thread to the board exactly at that point, we shall find that the board will hang evenly around it on all sides. Of course, we can try the same experiment with a plate, or a slate, or any similar flat object.

If we take such a complicated thing as the human body, we certainly cannot easily find its centre of gravity. The body is very irregular in shape, and it is made of different parts of very various densities. Nevertheless, it has been possible by long study to find one deeply interesting fact. It is one of the most important facts of the whole body, because upon it depends the erect attitude, which means the freedom of the hands from purposes of walking, and the chance to make use of them for all the great human purposes.

THE GREAT JOINT THAT DIVIDES OUR BODY INTO TWO HALVES

If we look sideways at anyone walking, or if we look sideways at a skeleton, we can see that the hip-joints make the great joint which really divides the body into an upper half and a lower half. As we know very well, the trunk and head and arms can swing backwards and forwards upon the lower limbs at the hip-joint. Now, suppose a line were drawn straight down to the earth from the centre of the hip-joints of anyone who is standing. We have here a problem, as we can readily see, which is very like the problem of the board hung by a string. In this case the support is below instead of above, but that does not really matter.

Now, if we understand the principle of the centre of gravity, we can see for certain what must happen to the upper part of the body, as it is supported through the straight line down to the earth, from the hip to the heel. If the centre of gravity of the trunk and head lies so that the line dropped from it to the earth will lie in front of the line from the hip-joint to the earth, then the body must topple forwards. The centre of gravity of the upper part of the body is found in front of the line through the hip-joints in the case of all animals, like the horse and cat, and so on; and that, of course, is why they have to walk as they do. Only by muscular effort and a certain degree of skill can a horse or a dog walk on its hind legs.

WHY IT IS DIFFICULT FOR BABIES AND ANIMALS TO STAND UPRIGHT

Even of the man-like apes, including the wonderfully erect gibbons, which we may see any day at a zoo, it is true that the centre of gravity lies in front of the hip-joints. They can walk very well for a time, but it costs them labor, and they can scarcely stand. A very small baby is in exactly the same plight as these animals.

But as the baby grows the curve of its backbone changes in such a way that the centre of gravity of the trunk now lies, as it does in all of us, behind the hip-joints. The two lines dropped to the earth, one from the hip-joints and the other from the centre of gravity, are parallel, and the forces acting through them make a couple, so that the trunk and head tend to rotate and roll backwards to the ground at the hip-joints, leaving the legs erect. That, however, is a thing which we never saw accomplished even by the most skilful acrobat.

It is prevented by the special development in our bodies of two huge bands of

fibres, one in front of each hip-joint, which prevent the trunk from rolling backwards under the influence of gravity. This beautiful arrangement means that, instead of standing upright only by muscular effort and careful balancing, we can do so in virtue of self-acting mechanical principles. Someone may say that all this is not the story of the earth; but the body is the child of earth, and the laws of the earth act in it and upon it, and the body is successful in so far as it obeys and is adapted to the laws of the earth.

WHEN A THING IS STEADY AND WHEN IT IS UNSTEADY

We have already studied the various kinds of equilibrium, and learned their names—stable, unstable, and neutral; but, of course, we ought to be able to define the exact causes which make the difference between the equilibrium that is stable, or steady, and those that are neutral and unstable. Our study of the centre of gravity can explain this. The simple law is that anything is in a state of stable equilibrium when the centre of gravity is raised by any disturbance, but it is in a state of unstable equilibrium if anything that disturbs it lowers the centre of gravity.

All this is quite plain if we think of the centre of gravity as the place where all the stuff of the body may be supposed to be collected. Now, if anything is going to raise that point, as, for instance, when we push against something hung from a string, then, when the force which raised it ceases to act, gravity, which is always acting, pulls the body back to where it was before. This is true of any case of stable equilibrium, such as that of the slightly tilted tumbler. But, of course, if the displacing force pulls down the centre of gravity, then, when it ceases to act, we cannot expect the body to return to its original position. There is nothing to make it do so; on the contrary, there is gravity to prevent it.

HOW AN EGG MAY ILLUSTRATE THE THREE KINDS OF EQUILIBRIUM

We can illustrate these cases, and also the case of neutral equilibrium, by an egg. For a second we may balance an egg on its point, but the tiniest disturbance will be fatal, because it means lowering the centre of gravity. This is a case of unstable equilibrium. On the other hand, we may have the egg resting on its side. Of course, we are assuming all the time that the yolk of the egg is unbroken and lies in the centre of the egg. Now we may roll the egg along the table by pushing it, just as we may roll a billiard-ball. In a little while, friction and the resistance of the air will stop it, and it will come to rest. The force we applied neither raised nor lowered the centre of gravity of the egg; its equilibrium was neutral.

But if, instead of rolling the egg by a push at one side, we try to tilt it at either end, we find that, after tossing up and down for a little, it will come back to its old position. So far as disturbances in that direction are concerned, it is in a state of stable equilibrium.

The reason is that when we tilted it we raised the centre of gravity, and when the finger was removed it returned to that position in which the centre of gravity is as low as possible. That, of course, must be the stable position—the position in which the egg as a whole is as near the centre of the earth as possible, so that the whole force of gravitation is on the side of resisting any disturbance of its equilibrium.

A COMMON ACCIDENT THAT HAPPENS WHEN MEN FORGET THE LAWS OF BALANCE

These questions of equilibrium and centre of gravity are of the gravest practical importance whenever the balancing of anything matters. Take, for instance, one of the most common and fatal of accidents, which happens somewhere or other almost every day in the year. We often hear that a row-boat has been upset and someone has been drowned. Except where the boat has been in a rough sea, it is safe to say that in every such case someone has been very foolish. There is a simple rule of safety which we all ought to know and act upon, or we may be responsible for the loss of one or more lives. The rule is that not more than one person at a time should stand up in a row-boat, and the lower even he crouches when he moves about the less danger there will be.

We see that this is a problem in equilibrium, and the whole question of equilibrium depends upon the centre of gravity. If the centre of gravity of the boat were in its keel, as in the case of those little toy bottles with half a bullet at their base, then the boat could not be so easily upset; it could be

tilted or turned upside down, but, at any rate, it would right itself at once. This is a case, of course, of stable equilibrium, where any disturbance means the raising of the centre of gravity. When we build what is called a lifeboat, we provide it, among other things, with a very heavy iron keel, which means that the centre of gravity is kept so low that, with the help of other arrangements, the boat, even when it is upset, has the power to right itself. But in an ordinary row-boat there is no heavy iron keel, and the greatest factors in determining where its centre of gravity lies are the bodies of the occupants.

WHY A ROW-BOAT CAPSIZES WHEN PEOPLE STAND UP IN IT

Directly we stand up, the centre of gravity of the boat is raised, and any disturbance is more likely to lower it, which means that the boat goes over. If two persons stand up together—especially if there is no one else in the boat—then the risk is very grave indeed. The accidents that cause the loss of so many precious young lives every year are usually due to two persons standing up in a small row-boat, in defiance of the laws of equilibrium and centre of gravity.

It required a great deal of experiment and labor to discover how to make a boat which should have its centre of gravity so placed that practically nothing could upset it. The great English Lifeboat Institution has such a boat, and probably the most essential thing about it is the lowness of its centre of gravity. There are other qualities, such as the power of righting itself when upset. This makes the modern lifeboat perhaps the most wonderful vessel that man has yet put upon the water, small though it be.

All these questions apply, of course, to great ships as well as to small ones, and it is a matter of the utmost importance that the weight of a ship shall be rightly distributed. It would be very easy to build a ship so that, when a wave made it roll, its tendency would be to roll over still further and overturn.

HOW THE BALLAST OF A SHIP PREVENTS IT FROM TURNING UPSIDE DOWN

Many of us have been in a ship at some time or other, and we know that, when it rolls to one side because of a wave, it rolls back again. It may never have occurred to us why it does this. Now that we have learned Newton's first law of motion, we shall naturally ask this question. The wave started the ship moving in a certain direction; according to Newton's first law, the ship must go on moving in that direction until something stops it.

When we look into the matter, we find that the weight of the water which the ship has displaced acts upon the ship and tends to right it; but for this to happen—and no vessel could live in anything but the smoothest sea if it did not happen—the centre of gravity of the ship must be low down. We see to this by having the ship's hold filled with ballast, something dense and heavy, the result of which is to lower the centre of gravity of the whole ship.

If for any reason the ballast were taken and thrown out of the ship, the result would be the same as that of standing up in a row-boat. It means that the centre of gravity of the ship is raised, and this means that the equilibrium is less stable, and that it is much more liable to be overturned than it was before.

THE LIFEBOAT AND THE SUBMARINE, THAT ARE BASED ON THE LAWS OF EQUILIBRIUM

Long experience has enabled men who build ships to understand and master these principles in practice, so that, as we have seen, such a vessel as the modern lifeboat is scarcely capable of being improved upon. In recent years, however, men have been trying to make new things, the success of which depends upon the laws of equilibrium.

Submarine boats are an instance of this, and most of the difficulties have been mastered in this case; but it is the making of vessels to fly in the air that furnishes us with the greatest difficulties. The case of an ordinary balloon is quite simple, provided that the air be still. The ballast and the bodies of the passengers ensure that the centre of gravity shall be very low down, but even in such a case as this a violent wave of wind may upset the balance.

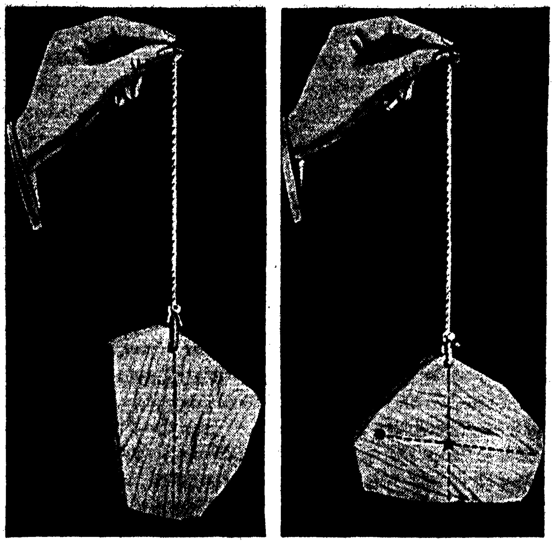
The problem becomes much more serious and difficult when we take the case of a flying machine, and it is a great mistake to suppose that anyone has yet accomplished the feat of making a flying machine whose equilibrium can be relied upon no matter what the wind is doing. This will be quite plain if we go back to our principles. They are very simple, but they apply everywhere. We know

that all motion depends upon forces; we know that all rest and all states of balance depend upon the relations between forces; and we know that there is a constant force of gravitation always acting, and always acting equaly.

So long as we have only gravitation to reckon with, our problem is simple. Anyone can learn to make a boat that will float on still water, or a balloon that will stay right side up in still air, or even a toy flying bird that will do the same. The difficulty arises when we have to reckon with other forces which vary to any degree in their direction and in their strength. That is the problem for the machine that is to fly in the air no matter what the air is doing. The case is made specially difficult by the fact that, if the machine is to carry passengers, it must retain its right position always; it cannot be allowed to turn turtle, and then right itself. Probably no one can yet say whether this problem can really be solved.

A similar problem, but one that is not quite the same, has been perfectly solved by birds and by many insects. The bird is subject to all the laws which we have discussed; gravitation is constantly acting upon it; the pressure of the air downwards and of the air in motion, which we call wind, acts upon it also.

The bird has solved the problem of making power in itself that will keep it up even though the specific gravity of its body is greater than that of the air. Now that problem has been perfectly solved by man in modern flying machines. This is not to say that man has made or ever will make engines that have as much power in proportion to their weight as a bird's muscles have. But the difference is only one of degree. There yet remains the thing which the bird can do, and which we cannot do, and that is to fly and remain in almost any state of the air. Long and careful study has been made by many observers of the manner in which the bird balances itself. Photography has been called in for this purpose, and something has been learned by the kind of photography that is used for making moving pictures.



These pictures show how we may find the centre of gravity of any flat object, such as a board. We suspend it from any part of its edge, and when it comes to rest draw a line in continuation of the line of string. Now we suspend the board from another point and draw a second line. The centre of gravity is situated exactly where the two lines cross.

So far as we can learn at present, it seems that the success of the bird is a success which only life itself can achieve, at any rate, in such degree. However this may be, it is worth noting that the bird, like a lifeboat, can, in a sense, turn turtle, and then right itself again. The bird recovers, and so does the lifeboat; but the case of the lifeboat, and still more of the flying machine, is very different from that of the bird, because these contain passengers, and they must be thrown out. It is as if we asked a bird to fly with a penny balanced on its back, and the conditions were not merely that the bird should fly no matter what the wind was, but also that it should not permit the penny to slip off. No bird could accomplish such a feat, but that is the feat which we ask the flying machine to accomplish. We are still very far from enabling the machine to do what the bird can do, but it is certainly worth our while to remember that we are also asking it to accomplish not merely what the bird does, but what even the bird cannot perform.

We must not leave the subject of gravitation without referring to what is, perhaps, the most important of all

the questions it raises—much more important than even the question of flying machines or the floating of boats. If it be true that here is a force which acts for ever, tending to pull every particle of matter in the universe towards every other particle, why does not all the matter in the universe collect into one great solid ball?

THE OLD IDEA THAT EVERYTHING MUST HAVE A BEGINNING AND AN ENDING

Now, there are two possible answers to the question, and it is necessary for both of them to be carefully considered and explained.

The first answer is now disputed by some thinkers, but we ought to know that it was once believed. It might be that this process of gathering together all the matter in the universe under the influence of gravitation was indeed going on, and had been going on since the universe was first made, but that there had not yet been time enough for it to result in gathering everything together into a solid ball, though there might be no doubt that such an event must eventually happen. This has in it the ideas of beginning and ending, which people have always been inclined to believe, and which, at first, most of us will think must be true.

Not very many years ago these ideas of beginning and ending were supposed to be strongly supported not only by the existence of the law of universal gravitation, but also by the behavior of heat and power in the universe. Men thought that the universe was like a machine which had been wound up and set running, but which in course of time must run down. One great thinker stood out against these notions and said they could not be true, and that was the famous English scientist, Herbert Spencer.

THE THEORY THAT A FAMOUS THINKER TAUGHT ABOUT THE UNIVERSE

Spencer declared that, though we could not name or discover them yet, there must be other forces in the world which acted in the opposite direction to those we knew, such as the force of gravitation, and that the history of things in general must be a rhythm, like a wave going on and on for ever, "from everlasting to everlasting," as the Bible says of God.

Now many have come to believe that Herbert Spencer was right, and that the answer to the great question of what must be the consequence of gravitation is not what people supposed. Of course, we do not need telling that if what we have asserted about gravitation be true, and if there be no other force opposing it, it *must* at last have the consequence of gathering together all the matter in the universe. But we are now beginning to know something of the wonderful forces, also always at work, which act in other directions.

For instance, men have lately proved to absolute certainty the existence of a force which is exerted by light, by radiant heat, and by other forms of radiation, which are known as *radiation pressure*. Everyone has heard of gravitation and very few people have heard of radiation pressure, but the one is just as important as the other.

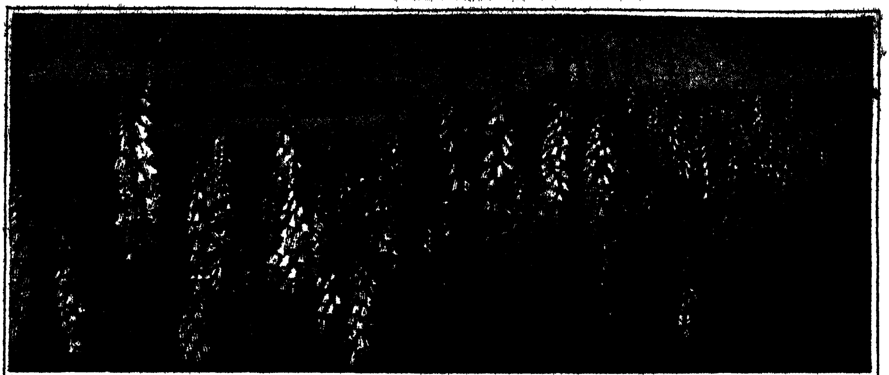
A FORCE THAT ACTS AGAINST THE PULL OF GRAVITATION AND SCATTERS THINGS

This pressure acts in exactly the opposite direction to gravitation, and though, under the conditions we know best, gravitation is much the stronger and has its way, yet under other conditions, which are just as common in the universe taken as a whole, radiation pressure is stronger than gravitation, and has its way, with the result that the matter which is acted upon, instead of being gathered together into a solid ball, is scattered.

The discovery of radiation pressure is of great importance to science, but it is of far greater importance in another way, and that is why we must mention it here. Its highest importance is that it helps to give us new ideas of the universe itself. Without this discovery the law of gravitation was a great argument in favor of the old view which looked upon the universe as something which had been made and set running, and must eventually run down.

There is a great difference between this idea and the latter one, for which some now claim the support of science as well as of pure reason—that the universe has neither beginning nor ending, but is an eternal thing, the eternal revelation of the Eternal God, who sustains it "from everlasting to everlasting."

THE NEXT PART OF THIS IS ON PAGE 3977.



There is no more charming wild flower than the foxglove, a single plant of which produces over a million seeds. Were it not for birds and insects, foxgloves would soon overrun the whole country.

HOW PLANTS TRAVEL

CONTINUED FROM 3816

We already know some of the ways in which the parent plants send their seeds into the world, so that they may have a chance of finding fresh ground where they will thrive. But, in addition to the various interesting methods described on page 3809 of this book, there are other clever plans that plants have hit upon in order to make their way in the world.

Some of the weeds that now overrun our fields were not known here until recent years; and, on the other hand, some of our own weeds have managed to get taken to distant countries where they were unknown. Some of these weeds, too, when they reach a new country, flourish so well that, for a time at least, they become a greater nuisance than they have been in their own land.

Many European plants have traveled thousands of miles, even to far South Africa and Australia; and some of them have been met with on lonely islands in the South Seas. How do they get so far to these islands, where the sea is all around? They go in ships, just as we should go. Some of them are carried by birds, perhaps in easy stages, instead of going direct, and a few have been taken out by emigrants, who thought they would like to have some of their favorite wild flowers growing around their houses in the new country to remind them of the old home they have left. In this way, years ago, a Scotsman who was leaving his native land to settle in Australia took with him some seeds of the thistle and other plants. He sowed the seeds, and they came up so well in the new soil that his thistles were greatly admired, and every Scottish settler for many miles around went to see the familiar plant of the old country, and all begged for seeds. In a few years thistles had taken such a hold of that part of the country that the farmers ceased to admire them, and felt not at all inclined to bless the patriotism of the man who had first sown its seeds there.

In much the same way the water cress was taken to New Zealand. In Europe the watercress is never a nuisance, because it grows on the muddy margins of streams, or across the beds of shallow brooks. But in New Zealand it rapidly spread from the brooks and streams into the rivers, and grew so large and strong that it filled up the waterways and prevented boats from traveling on them. These plants were taken abroad with a purpose; but there are many that have

been taken by man without his knowledge. Years ago, before North America was so well peopled by white men as it is to-day, one of the European weeds, the plantain, found its way here. Nobody would want to take such a plant with him, for it has no showy flowers, and is not eaten by us. But its seeds came from Europe with the immigrants, and wherever they made their homes, on the prairies and in the backwoods, the plantain sprang up, and then the Indians gave it a name; they called it the "White Man's Foot."

HOW THE "WHITE MAN'S FOOT" WAS BROUGHT TO AMERICA

They merely jested when they thus hinted that it was the white man's foot on the earth that caused this plant to spring up. It is very likely that the first plantain that grew in North America really did spring up in that manner; but there was no magic in it. Probably some early settler, when preparing for the journey to his new home, packed up the heavy boots in which he had walked behind the plough at home, and did not put them on again until he reached the new land. Now, if we suppose that a little of the English earth was clinging to the soles of those boots, the mystery is solved. It is almost impossible to take up from a field as much of the surface soil as will cover a quarter without having in that soil a number of the seeds of some of our weeds.

Sir Joseph Hooker once related a little story that made this matter very clear. An exploring party, of which he was one, landed on a lonely island at the other side of the world. No one lived on this island, and the visitors thought that they were the first men that had ever set foot upon it. But soon they came upon some of the common English chickweed, and, using the patches of this plant as a guide, they came to a low mound which was covered by it.

A SPADE THAT CARRIED ENGLISH CHICKWEED ACROSS THE WORLD

The mound was a grave in which a British sailor, who had died at sea, had been buried by his mates. It is almost certain that the spade with which the grave was dug had already been used where chickweed grew, and a few of its seeds had clung to it, to be brushed off on this far-away island, where they germinated and grew. There are many stories of the way in which common weeds of one country have been carried to other countries where they were unknown before, and we must say something of the way in which plants make their way without the aid of man. Many of the winged seeds, and those that have parachutes or sails, are blown for long distances by the wind. The wind drops them, and they sprout and grow into plants which produce flowers and seeds. The second crop of seeds are blown farther in the same course, or in several directions, and year by year that plant is found farther and farther away from its old home.

The seeds of waterside plants are carried for miles by water—perhaps for hundreds of miles—before they are caught by the muddy bank. The cocoanut, that we know so well, is borne by the sea, securely wrapped in its great coat of fibres, from island to island in the Southern Seas. Scarcely has a coral island risen to a level with the surface of the sea before numbers of cocoa-nuts are washed upon it, and there they grow and soon cover the island with tall, graceful palms.

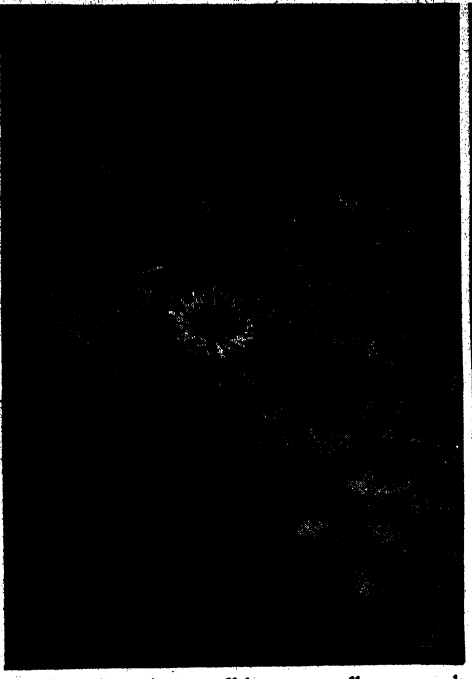
A CUPFUL OF MUD THAT CONTAINED FIVE HUNDRED DIFFERENT KINDS OF SEEDS

Hooked seeds cling to the fur of beasts and the feathers of birds, and are carried far away. Birds not only carry seeds, but also bits of waterweeds clinging to their feet; and many birds fly enormous distances when they migrate. Years ago Charles Darwin caught some birds of this kind and washed the mud off their feet, and from it he grew a large number of plants, the seeds of which were in the mud.

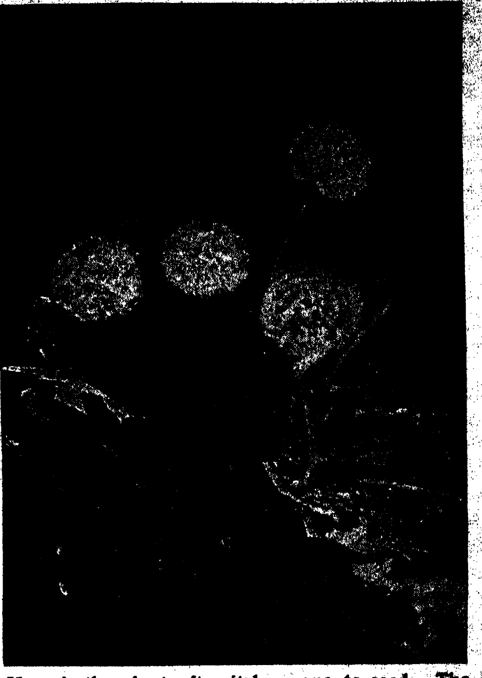
To show how easy it was for birds to pick up seeds when they hopped along the shores of muddy ponds—into which millions of seeds are washed in rainy weather—he took three tablespoonfuls of mud from a little pond and put it into a breakfast-cup. There were many seeds in it, and as they sprouted and got large enough for him to see what they were, he pulled each one up to allow room for others, and kept count of them. From that small quantity of mud he obtained no less than 537 plants of various kinds!

We cannot walk through a field or wood in summer or autumn without a

THE DANDELION'S LITTLE PARACHUTES



The dandelion, that we all know so well, was much used and appreciated by our forefathers for salads and as a medicine. Even now it is taken in the form of a drink by people who suffer from indigestion.



Here is the plant after it has gone to seed. The yellow petals have fallen off, and in their place there is a fluffy head, looking like a ball of down, that only needs a gentle puff of wind to carry it far away.

This fluffy head is made up of many seeds, to each of which is attached a number of tiny hairs, that spread out like a parachute, causing the seed, when it falls, to drop seed downwards.

Here is an old flower-head with a single seed magnified. The seed is pointed, and so is able to enter the soil when it falls. The parachute, catching every puff of wind, works the seed well into the ground.

large number of seeds clinging to our clothes, and though some of these will get knocked off again very soon, we shall find many still clinging to us when we reach home. Even in the case of those seeds that have been shaken off, the purpose of the plant has been served by their being carried some distance away, where they may find a more suitable soil and have more room to grow.

DIFFERENT KINDS OF PLANTS THAT GROW IN DIFFERENT KINDS OF PLACES

Nearly all plants have their special liking for certain places in which to grow, and the people who make a study of them—*botanists* they are called—know the exact kind of place in which to look for any plant they want. There is one set of plants we shall never find away from watersides or marshy ground. Others we must look for on peat-bogs. The field flowers differ from those we find in the woods, and these again are unlike those we get on the hillside or on the open downs.

The mountains, with their shallow soil and bare rocks, have their own plants, and many of them will not grow in the richer and deeper soils of the lowlands. Some of them go farther than this in their likes and dislikes; they must have a distinct kind of soil. For instance, this one will only grow upon soils of which chalk or lime forms part; that one will surely die if planted in soil that contains any lime. One must have a loose, sandy soil, while another prefers a stiff loam or clay, and so on.

Then they are particular about the amount of light they get, one insisting upon shade, another thriving only in full, hot sunshine. One likes to have the salt-laden sea-breezes blowing upon it; another cannot live anywhere near the sea. And thus it is that in the tropics we shall find a set of plants quite distinct from those in cold climates, or in the temperate region.

WHY SOME PLANTS WILL GROW ONLY IN HOTHOUSES

That is why, when plants are brought from India and South America to a temperate climate, we have to grow them in hothouses; and the plants from countries that are warm, but not so hot as the tropics, we protect in greenhouses, where they will be safe from any touch of frost. The plants that grow high up in the mountains we call Alpine plants, and for these in gardens we have to provide blocks of stone under which their roots will find coolness and moisture, that enables the leaves and flowers to stand the full glare of the sun.

A number of plants can only grow on the remains of other plants. An example of this kind will be found in the bird's-nest orchid, which has no leaves, and is of one dingy yellow-brown color all over. Other plants fasten their roots to the roots of their neighbors, and rob them of the food these roots are getting from the soil. But these have green leaves, and work up the raw food they have stolen into leaf-stuff and flower-stuff. They are known as root parasites, and in this class come the cow-wheats, the eyebright, the red and yellow rattles, and the louse-wort, that grows in marshy places.

The mistletoe is only a partial parasite, for it has green leaves. Other plants, like the broom-rapes and the dodders, are wholly parasites, taking everything they require from their victims, and not putting forth a single leaf, or having a spot of green color about them. All these we shall have to talk about in their proper turn.

THE MOULD, WITHOUT WHICH PLANTS WOULD STARVE TO DEATH

We have already seen that all but the very tiniest of plants must have *mould* to grow in, and that this must be made by plants. If we were to dig up pure clay or sand from deep down in the earth and try to grow plants in it, we should find most of them would fail. They would be starved because, although they want this clay or sand, they want other things mixed with it.

Mould consists of such soil broken up and well mixed with the decaying leaves and stems of other plants. This makes it lighter and holds moisture, and so enables the fine rootlets to work their way among it and feed upon it. The different amounts of this decaying matter is known as *humus*, and the different kinds suit it for plants of various tastes; for plants have likings just as animals have. The plants that thrive in a beech-wood will not live in a pine-wood, though the amount of light and moisture may be much about the same in both places.

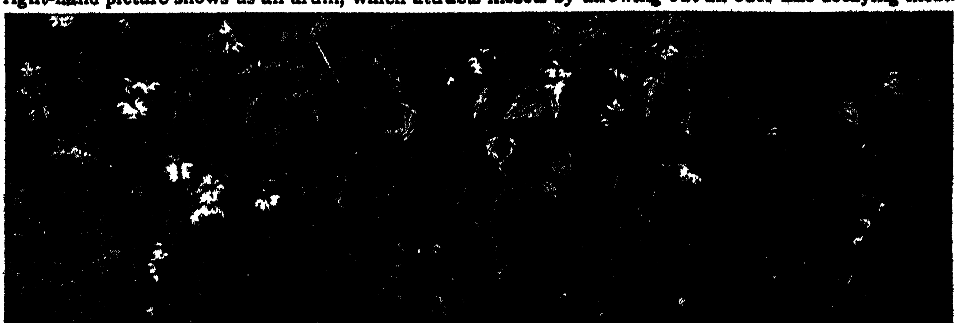
We have possibly noticed how large a number of seeds one plant will produce

PLANTS THAT IMITATE OTHER PLANTS

Some plants protect themselves by growing like other plants which have strong defensive powers. In the first picture brook-lime, on the left, saves itself from being eaten by imitating peppermint on its right. The right-hand picture shows the dead-nettle, which has imitated the poisonous stinging-nettle on its right.

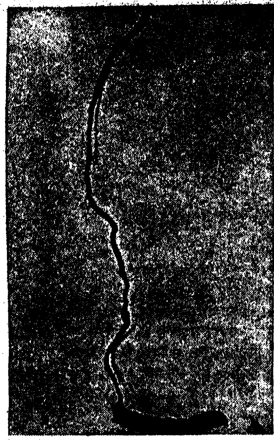
Plants, in self-defence, imitate not only each other, but also their natural surroundings In this flower-pot lie some examples of a South African plant which look like stones, and so cattle pass them over and do not eat them.

The objectionable stinging-nettle is not only a protection to the dead-nettle, but also to the horehound. On the left of the first picture we see the horehound growing beside and resembling its adopted guardian. The right-hand picture shows us an arum, which attracts insects by throwing out an odor like decaying meat.



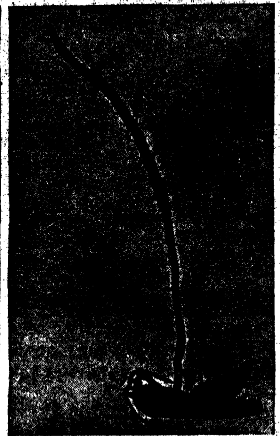
This is another picture of the stinging-nettle and the dead-nettle growing side by side. The stinging-nettles can be recognized by their flowers, although, when the dead-nettle blooms, its flowers are more attractive.

THE PLANT'S GREAT STRUGGLE FOR LIFE

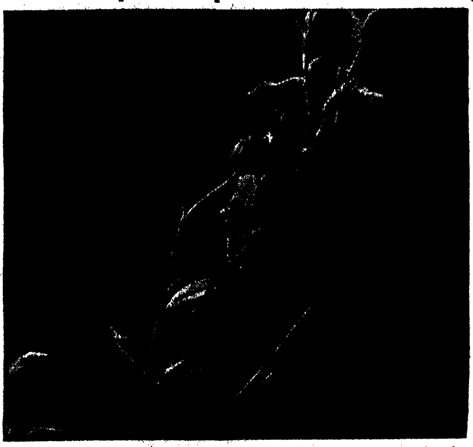


This picture shows a curious New Zealand fungus growing out of the body of a caterpillar.

The fight for life is as keen in the vegetable as in the animal world. Here is a grass-blade that has forced its way through a hard root.



Here is a fungus like that on the left growing out of an insect which it has killed.



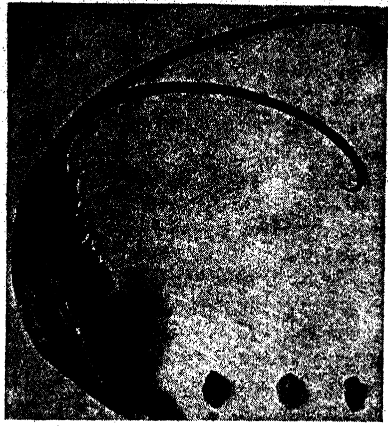
One of the best known of our climbing plants is the convolvulus, shown here. It will take hold of any other plant in order to lift itself into the sunlight.

The dodder not only climbs round other plants, as it is doing round the nettle, but attaches itself to its victim by means of circular discs, and feeds upon it.

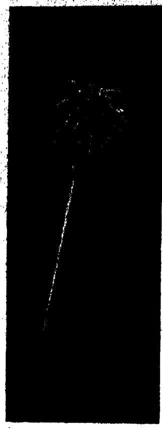
The dodder is a strange plant, for it has no leaves, and this is why it is compelled to draw its nourishment from the plant upon which it grows. Here we see the dodder climbing up and strangling the heather.

Here we see part of the same dodder magnified. The flowers belong to the dodder, and not to the heather.

SEEDS THAT TRAVEL LONG DISTANCES

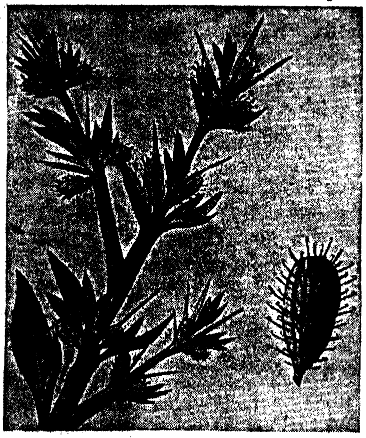


The seed-pod of the martynia, a tropical plant, has two hooks, that catch in the coats of animals. The pod is thus carried about, and the seeds are sown in new places.



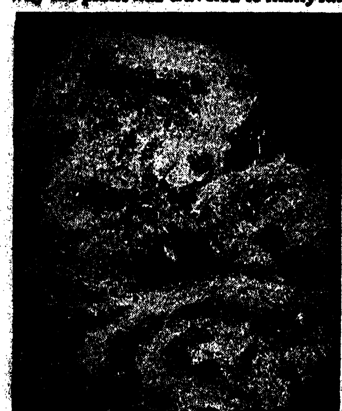
An English plant, the common hedge avens, has a head of hooked seeds.

Here is an avens seed magnified, and it will be seen that it bears a resemblance to that of the martynia. The martynia is, however, much larger than the picture.

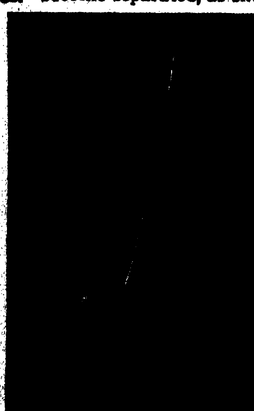


The seed of the Bathurst burr, shown here, gets into the wool of sheep, and in this way the plant has traveled to many lands.

The bulrush, which grows in marshes, is a plant that, when ripe, as seen in the upper part of this picture, has myriads of seeds. These become separated, as shown below, and the wind spreads them.



Here is sheep's wool, laden with various seeds. In Australia, the Bathurst burr, carried thus, has become a pest.



The willow herb has its seeds contained in a kind of pod, that is shown in the picture.

When ripe, the willow herb's pod, seen in the last picture, bursts, and the seeds are blown long distances by the wind.

in a season. In all plants the number is very large; in many, such as the oak-tree, which drops thousands of acorns every autumn, it is enormous.

WHY PLANTS THAT SCATTER MILLIONS OF SEEDS DO NOT SPREAD OVER THE EARTH

A single poppy-head bears countless tiny seeds. One foxglove plant scatters one million and a half of seeds. Yet in the place where they grow, if we watch year by year, we shall find that the numbers of poppies and foxgloves are always much about the same. The wood will appear to have only as many oaks in it this year as it had ten or a hundred years ago, and the reason for this is quite plain.

Every plant has its enemies—slugs, insects, birds, and beasts—eating its seeds, killing its seedlings, or hurting the full-grown plants. The greater the dangers a plant has to face, the larger will be the number of seeds it has to produce to ensure that one of its children shall grow up to produce flowers and seeds in its turn, and so keep the race going. If in autumn we look in a wild garden where foxgloves have bloomed, we shall find the seedlings coming up thickly together.

Now, if we consider how large the leaves of the foxglove become before they send up their flowering stems, we shall see that there is not room for them all. What happens? They are not all as strong and healthy as each other, and so the strongest and best fitted to produce flowers starve and smother the sickly ones. That is one reason why the stem of the foxglove sways in the wind, and the mother plant tries to throw her seeds as far away as she can, to give all her children a chance of coming up. But still the sickly ones must suffer and eventually be starved to death. It seems very cruel, but it is only in that way that the fine vigor of the race can be kept up.

THE THOUSANDS OF LITTLE OAK-TREES THAT FAIL IN THE RACE OF LIFE

Of the many thousands of acorns that an oak will ripen in a good year, by far the greater number never have a chance to sprout. Deer, pigs, squirrels, and mice will eat them; so will the jay and other large birds. But still, if we go to the oak-woods in May or June, we can see that vast numbers of seedling oaks, a few inches high, have shot up, and are standing in crowds under the trees. Very few of them will be alive at the end of the year, for some of the many oak-eating insects will destroy them; rabbits will nibble them to the roots; and the only acorns that appear to have a chance of becoming trees are those that have been dropped by a jay or crow in the field or hedgerow, and just one here and there that has managed to fall in some spare corner of the wood. All this huge supply of acorns is to ensure that the race of oaks does not die out.

When a large oak-tree is cut down by a lumberman, or is struck down by lightning, it leaves a great clear space in the wood that used to be shaded by its long branches. In such a space thousands of seedling oaks will come up, and as they will here get more light and air than they would where the trees are close together, they will grow more quickly and strongly, and a few will escape their enemies.

HOW THE OAKS OF THE FOREST WORK TO PRESERVE THEIR RACE

But the struggle will still go on between these little oaks, until the one strong tree will conquer the others, and fill up the space that the fallen tree once filled. To fill up that space, and to extend the wood on all sides, all the oak-trees in the wood produce their crops of acorns.

What has been said about the foxglove and the oak applies to all plants. Scarcely one attains to its full size without having fought hard for its life. Even if an acorn is dropped in the middle of a field by a jay, or gets there by some other means, it has in its early days to wage a battle for its life with the grasses, and if it succeeds in getting to the height of a few feet, it is then liable to be so injured by horses or cattle nibbling at it or trampling upon it that it dies.

Thousands of young trees spring up from winged seeds, far away from their parents, and struggle for years against browsing sheep and cattle, and never get higher than the grass. But if they happen to fall into a fence corner, and can grow up to the light, they may in the end win the fight, and, by shutting out light and air from the older bushes, kill those that attempted to kill them.

THE NEXT STORIES OF NATURE ARE ON PAGE 3943.

HOW TO SWIM AND DIVE

CONTINUED FROM 3786

SWIMMING is one of the healthiest and most enjoyable of sports. The ability to swim may enable any boy or girl to perform that greatest of all deeds—the saving of a human life. We can learn to swim almost as soon as we can walk; the babies of the South Sea Islands, indeed, are able to swim before they are strong enough to walk, and, out there, any native child who is not at home in the sea would be a curiosity.

It is quite possible for us to teach ourselves to swim, especially if we are confident, but we shall learn much more quickly if we have a friend or parent who can give us a helping hand. Water is quite able to support our weight, and we can easily prove how buoyant it is by standing with the water up to our waist and then trying to touch our toes. It is almost impossible to do this, because of the lifting power exerted by the water.

For our first attempt let us walk out into the sea or pool until the water reaches just above our waist. Turning towards the shore, we should ask a companion to put one hand under our chin and the other hand under our body. Thus supported, we must hold our head well back, close our mouth, and breathe only through our nostrils. It is, perhaps, best at first to work the arms only, so that we can fix our attention on them alone, letting our legs remain stretched out stiffly. Keeping our fingers and thumbs close together, and placing both hands just under the chin, we push our hands out as far as we can, thumbs touching, palms downwards, and the backs of the hands very slightly curved, just under the surface of the water. We then turn the palms outwards, and bring the arms round in a wide and strong sweep until they are in a straight line with the body. Next we bend the elbows, bring them to our sides, and place our hands in front of our chest ready for the next stroke. This movement is easily mastered, and we can now turn our attention to the leg-stroke. In order to do this accurately, we first gently draw both legs towards the trunk, the backs of the heels touching, and the knees and toes pointing outwards; the soles of the feet should be just covered by the water. We then kick both feet out strongly at an angle to the body, so that at the finish of the kick our legs are quite wide apart, and, without pausing, we bring both legs quickly together, being careful not to bend the knees. It is mainly this last movement that drives us along, and our companion will soon find it necessary to walk along beside us. We must not hurry in striking out with our hands and drawing up our legs, as these are negative movements. The legs should be drawn up as the arms are swept round, and kicked out as the arms are pushed forward. The breath should be taken in when the arms are wide apart. In kicking out, the best swimmers give the legs a kind of twist or screw as if working a paddle.

Should no friend be with us, we shall find that when we lean forward and push our arms out, our legs will rise towards the surface of the water.

We must next learn to swim on our backs. This is most important, as it is one of the ways by which drowning or unconscious persons are brought to land. It is, too, the least tiring method, and in long swims in deep water, if we turn and swim on our backs, it will enable us to rest our muscles and lungs. The stroke is very similar to the breast-stroke, only we lie on our back. A companion may assist us by placing his hand under the hollow of the back, but if we can swim easily on the breast we shall not need help. Stretching out our arms to right and left, we must lean back on the water and

lift our feet off the ground. Our legs will come readily to the surface if we keep our head well back with our ears under the water, and, if we lie quietly, we shall find that we do not sink. To move along, however, we bring our hands to our sides. Both arms are then brought out of the water in a circular sweep, and placed in the water as far behind our head as we can reach. The thumbs should touch in performing this movement, and the hands should turn so that as they enter the water the backs of them meet. The palms are then ready to present as large a propelling surface to the water as possible when the arms are brought in a wide and powerful circular sweep just under the surface, until they lie straight along each side of the body. The legs are brought up and kicked out just as for the breast-stroke. Should the arms be tired, they can be folded on the breast and the legs alone worked, the breath being taken during the finish of the kick-out.

THE SIDE-STROKE AND THE OVER-ARM STROKE

We now come to the side-stroke and the speedier overarm stroke. Turning on our right side, we push out our right arm in a straight line with the body, the fingers and thumb being closed and at right angles to the surface. The palm is then turned outwards and the arm is pulled down strongly, without the elbow being bent, until it points to the bottom. The arm is then drawn in to the body by bending the elbow and turning the wrist inwards, and moved along in front of the chest until it is in a position to push out again from just under the ear. The left, or upper, arm moves alternately in the same way, but the hand cannot go so deep, and the elbow must be bent slightly, otherwise the body would roll forward. The only difference in the movement of the arms in overarm swimming is that the left arm is brought right out of the water and dipped slightly farther in front of the head than the hand reaches when it is not taken out of the water. The breath should be taken when the head rises well out towards the finish of this stroke, and it can be expelled quite easily when the head of the swimmer is under the water while the arm is swung over.

There are at present two forms of leg-stroke used in swimming on the side. In the older method both legs were drawn up under the body and kicked out widely, as in the breast-stroke. In the newer method, now adopted by all the best swimmers, the knee of the upper leg is bent but little, that is to say that the left foot is never drawn up, but kicked slightly forwards. The heel of the under leg is brought back towards the body. Both legs are then brought sharply across each other as in walking, the left leg being straight as it passes the straightened right leg, and not being bent back until it has again crossed the right leg. We can, of course, swim on our left side if it is easier to do so, and it is as well to practise swimming on both sides.

The trudgen-stroke of the American Indians remains to be learned by any strong boy or girl who desires to move fast through the water. It is at first very tiring, and cannot be kept up for long by any but the very best swimmers. Each arm in turn performs a circle through air and water, the palms being turned away from the body as much as possible. The leg-stroke resembles that used in the side-stroke, but it is shorter and quicker.

Some swimmers give a kick for each stroke of the arm, but this is very tiring; and it is perhaps best to kick every time we make a stroke with our stronger arm, taking in breath when our head is well above the water.

HOW TO DIVE GRACEFULLY

Diving is a valuable and graceful accomplishment for the swimmer. If we see a person drowning, we can always go over the boat or pier feet first, but by arriving in the water head first and arms out we can more easily and quickly take our first stroke. We must learn to keep our feet together, and legs, body, head, and arms in one straight line, as we enter the water. Thumbs should be locked and the backs of the hands uppermost. We come to the surface of the water by raising our arms upwards. In standing on a diving-board, our toes should project over the edge, and the spring is taken from the balls of the feet. In diving at the start of a race, we must dive as far out as we can without falling flat, and rise to the surface without a moment's delay, drawing up our legs for our first kick as we do so. We should never dive into water of unknown depth, and our eyes should be opened under the water.

The most important diving, however, is the least showy, and it is the art of going to the bottom from the swimming position. By lowering the chin on to the chest, rounding the back and swimming downwards with the arms, the legs are brought up and out of the water, and their weight then drives the body down, and by swimming with the head kept well forward the bottom can be reached.

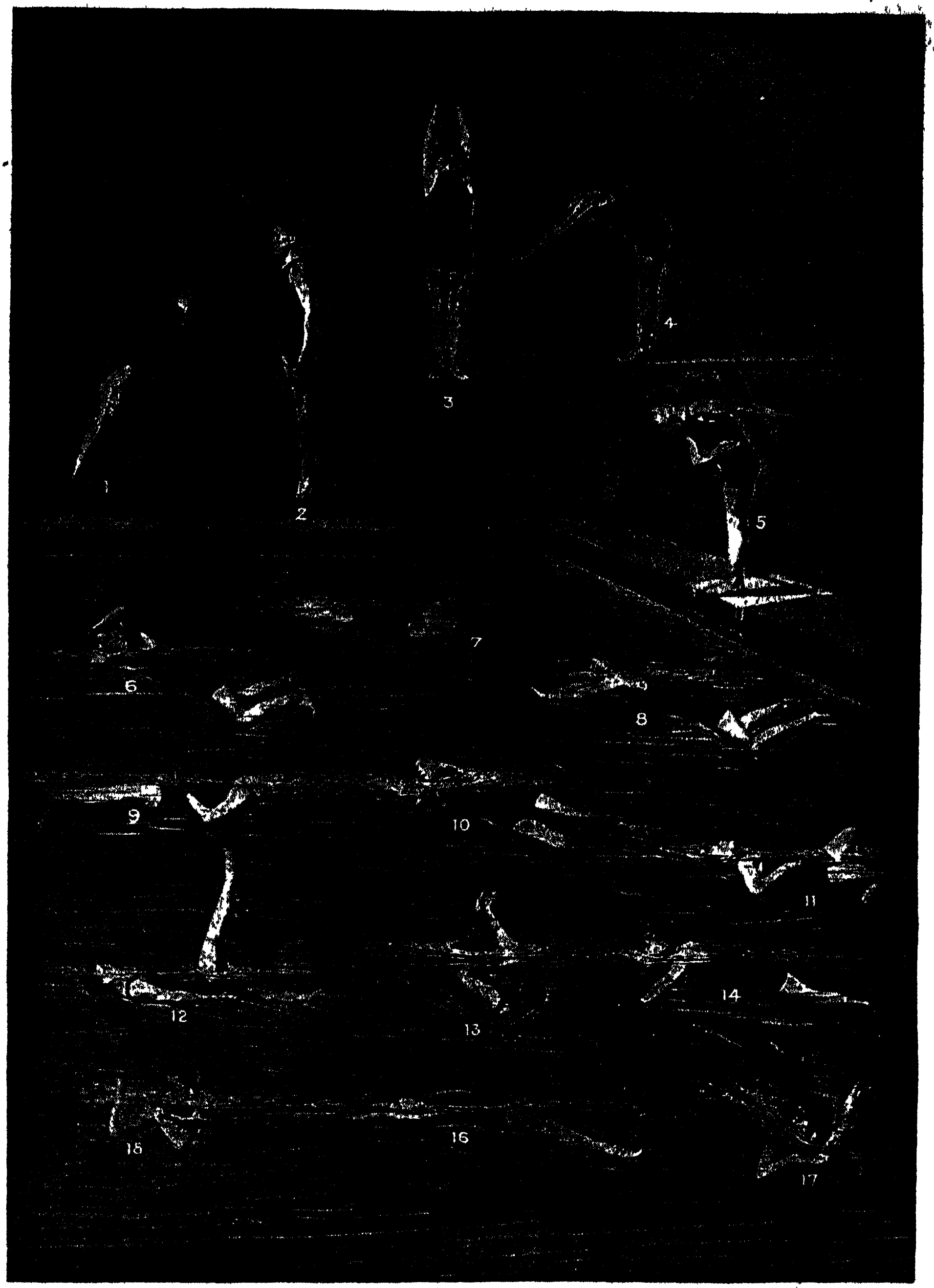
TRICKS IN THE WATER

There are many tricks that can be learned, such as swimming like a dog or crab, swimming with arms and legs tied, swimming like a porpoise, the nautilus, and somersaults on the surface of the water, and some of these strokes are shown in the picture on page 3899.

It is sometimes necessary to remain stationary by treading water. We literally tread water as though walking upstairs, or we may perform the leg-stroke used in swimming on the breast while the body remains in an upright position.

There are certain things that we must not do in bathing. We should on no account enter water beyond our own depth until we can swim at least fifty yards without a rest. In learning do not depend on cork belts, bladders, or water-wings, as these prevent the body from taking its natural position in the water. They have been known to slip, and thus cause the wrong part of the body to float and the head to sink. We must not hurry our strokes in learning. It is quite surprising how slowly we can take our strokes and make good progress. We should never bathe within half an hour after a meal, or at any time when very hot, very cold, or very tired.

THE ART OF SWIMMING AND DIVING



The photographs on this page give the different positions used in diving and swimming, and also some of the fancy tricks which we can all learn. How graceful it is possible to look in diving from a height is shown in 1, where the body is in almost a straight line. Diving feet first from a height is shown in 2. Here the diver will go deeper than in diving head first. A Swedish dive is being taken in 3, and a high dive in 4, while the way to dive in at the start of a race is shown in 5. No time must be lost in coming to the surface in this dive. Three of the positions the swimmer assumes in the breast-stroke are shown in sequence in 17, 8, and 14. Swimming on the back is shown in 7, the trudgen, or Indian, stroke in 6, the side-stroke in 10, and paddling on the back to rest the arms in 11. Of the many fancy feats, we see, in 9, the torpedo float; in 16, the dead man's float; in 12, the nautilus; in 13, turning a somersault; and in 15, swimming like a crab.

A FLEET OF LITTLE BOATS

BIG boats and small boats, heavy boats and little fairy boats we can make from fruits, nuts, and treasures of the garden and wood. Nimble fingers will soon build our little fleet; and in a big tub or bath, filled with water, we can set the boats afloat.

First we will make a gondola out of a banana-skin, choosing a perfect fruit, well turned up and flat between the ends. We cut down along the middle of the flat part, and through the opening cut the pulp into sections, which can be drawn out on the point of a pen-knife, leaving the skin perfect. Then we curve a piece of thin card, insert it towards the pointed end, and put a match for a seat towards the stalk end. We may have to put a copper coin in the bottom of the boat to steady it in the water. The result is seen in picture 5.

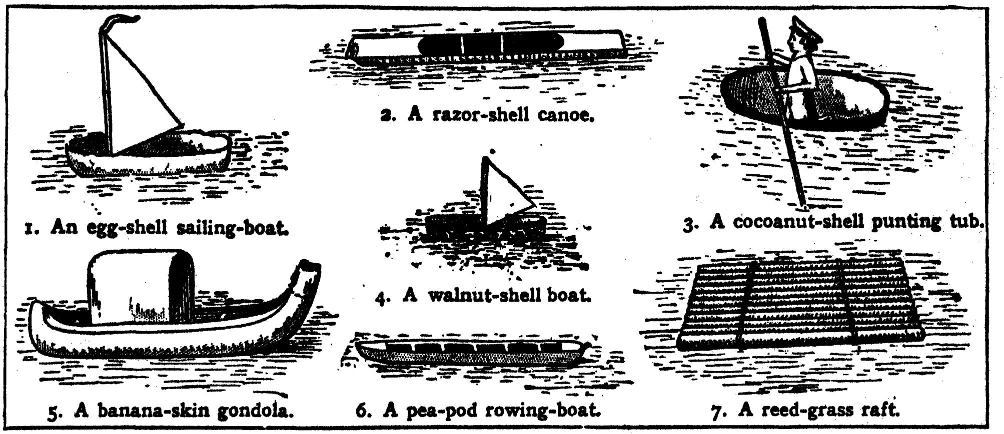
We can make another boat out of half a lemon or a small orange cut lengthways. We remove the pulp, and trim the edges with scissors, insert strips of card for seats, and put the coracle-shaped boat in the oven to dry and harden. Little wooden dolls to represent ancient sailors, with pieces of wood for oars, can be seated in the coracle.

For a rowing-boat we can use the half of a very large pea-pod with the stalk cut away. Small strips of card will do for the seats, as we see in picture 6, and, if we are skilled in cutting out, we can shape little card rowers with two oars each, made of card or grass-blades.

We know, of course, that cocoanuts float. So out of the sawn half of one we can make a round punting tub, and in it place a small wooden doll, with a stick for a punting pole, as in picture 3.

All these things make fairly large boats; but there are many things from which we can make dainty little ones. There is, for instance, the half of a walnut-shell. We divide the walnut carefully with a knife, taking pains not to crack the shell, remove the nut, and scrape the inside of the shell clean. As this is suitable for a sailing-boat, we get a piece of stiff white paper, gum one side round a piece of match-stick, and with a little sealing wax secure the mast to the bottom of the boat. Picture 4 shows us what it is like. The walnut is easy to halve, but not so an egg-shell; yet this makes a pretty white boat if we can manage to secure a sound half. Perhaps the best way is first to crack an egg in the middle and from that hole remove the shell in small pieces before carefully taking out the contents. It is better to leave an irregular edge to the shell, as in picture 1, than to risk cracking our boat.

As to the sail for this boat, it can be made of thin white paper fastened to a mast of very stiff paper folded in halves, with one end bent at right angles, so that the bent part can be stuck down to the inside of the boat with sealing wax, while the edge of the sail is gummed into the folded paper that forms the mast. Being fragile, the egg-shell boat may easily be injured in a collision. As shipwrecks do sometimes occur, it is just as well to have a lifeboat or a raft on our miniature sea. A raft might be made of match-sticks, or pieces of reed-grass roped together with coarse white cotton, as in picture 7. Small strips of cork, cut lengthways from the corks of bottles, will answer the purpose of a raft, and refuse to sink. Failing any other material, the raft can be shaped from a large flat leaf, such as the plane or ivy.



1. An egg-shell sailing-boat. 2. A razor-shell canoe. 3. A cocoanut-shell punting tub. 4. A walnut-shell boat. 5. A banana-skin gondola. 6. A pea-pod rowing-boat. 7. A reed-grass raft.

During the acorn season we probably gathered some acorns with their cups; if so, we have nice little punting tubs ready to be floated at once. An acorn in a cup can serve the purpose of a buoy, if we secure a thread to the stalk and a weight to the other end of the thread, which must, of course, be long enough to reach the bottom of our sea. The acorn can be cut in halves lengthways, the nut removed, and the shell used for a small boat, the flat end forming the stern, and the pointed end the bow.

The petals of flowers float easily on water, so that from them alone we can get dainty small boats of many colors. Red, pink, yellow and white roses will give us variety. As a rose petal is very fragile, a sail, if we wish for one, would have to be made of tissue paper, say pink for a pink boat. To form the mast we can roll the paper down one

side. A drop of gum or paste will be all that is necessary to keep it in its proper position.

In autumn the halved outer coats of horse-chestnuts and walnuts make strong little boats. Then, if we get a large piece of cork or a small block of wood, we can shape it into a modern warship, and even use monkey-nuts, acorns, or filberts for torpedoes. A fireship is made from a lump of camphor set alight.

Some shells make admirable boats, and float well. The long-shaped razor-shell answers for a canoe, as in picture 2. Paper can be pasted over the two ends, and an uncovered space left in the middle. As such a boat is comparatively large, it can be launched near the gondola shaped from a banana. Mussel-shells also make good boats; and small, black, closed ones will suggest to us not only dangerous torpedoes, but porpoises floating on the surface of the water.

For all these things we must use our imagination and inventiveness; and we shall be surprised to find how interesting boat-making can be when we go to Nature's wonderful storehouse for materials wherewith to build them.

HOW TO KEEP FRUIT FRESH

UNFORTUNATELY for boys and girls, and for grown-ups too, fruit becomes ripe only in the autumn, so that at one season of the year we may have more fruit than we can eat with comfort to ourselves, and at other times, when we would like to have certain fruits, we cannot have them, either because the season of that fruit has passed or has not yet come. But in this age of great inventions and progress we are far more fortunate than our grandparents were, and even than our parents were when they were as old as we are now.

We get large supplies of fruit from California in the west, and Florida in the south, to say nothing of the great quantity of tropical and sub-tropical fruit shipped from the West Indies.

Thanks to the quickness with which railway trains and modern steamships can carry fruit, and to the modern methods of keeping fruit while it is being carried on the ocean, we have two seasons a year for many kinds of fruit. But, in spite of that, it is as well to know how to keep fruit longer than we can do by letting it lie about without any special measures being taken to prolong its life. So we shall learn how to dó it in this article.

First, we must know what causes fruit to spoil. The decomposition of fruit, as we call it, is caused by the attacks of microbes, which are the very tiny little living things that we read something about on page 817. Once the microbes have begun to settle on fruit, it gets bad ever so much more quickly. Thus the effort to keep fruit fresh is really a fight between the microbes and ourselves. It seems ridiculous to talk about a fight between men and creatures so tiny that we can see them only with the help of a strong microscope. But, in spite of that, if we are not very careful the microbes will win the battle, and our fruit will spoil very soon. The microbes are bound to win eventually; we cannot help that. The most we can do is to beat them off for a time, to keep the fruit a few weeks or months longer than otherwise. We cannot make its freshness indefinite. If we know what conditions favor the growth of microbes, then we know that by avoiding or preventing these conditions we can make fruit remain fresh a little longer. Microbes thrive and multiply in damp and stagnant air; therefore our fruit should be kept in a place that is cool and shady, yet airy and dry. Fruit that is intended to be kept should be gathered when not fully ripe. Care should be taken not to break the skin, and any bruised fruit should be put aside to be eaten first. A dry, dark attic or cellar, with plenty of ventilation, makes a good place for keeping fruit. The fruit should not be heaped up. Each apple, pear, or other fruit should lie by itself, not touching its neighbor, and every few days each one should be examined, to see if it has begun to decay. If it has, it should be removed, so that it may not contaminate the rest. Wrapping each one in paper separately is a good plan, and if this is done the fruit need not be examined at such frequent intervals as when it is stored unwrapped. If these hints are followed, apples may be kept fresh for many months. Indeed, some fruits, such as winter pears, need to be kept for some time to get thoroughly ripe, as they do not ripen on the tree.

In America fruit-preserving has become quite a domestic art. The fruit is pared, cored, and put into glass jars, which are then filled with a hot, thin syrup, and firmly sealed. The syrup is made by dissolving sugar in water, and boiling it slowly for a few minutes after the sugar is dissolved. The solution must not be stirred after it has started to boil.

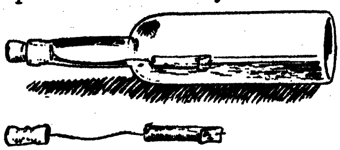
The spoiling of a can of peaches or other fruit is due to the development within it of great numbers of small forms of plant life, the germs of which are present in the fruit or the can before or during the process of canning. To prevent the fruit from spoiling, it is necessary to sterilize both the fruit and the jar. Sterilization consists in raising the temperature to such a point as will ensure that all the germs are killed. The fruit should be put into cans or jars as soon as possible after it is pared; otherwise the surfaces turn dark.

On board ship, in hotels, and elsewhere fruit is often kept in cold storage—that is to say, the temperature of the room or box in which the fruit is stored is kept down to a temperature of about 32 degrees Fahrenheit, which is freezing-point, by means of ice or refrigerating machinery. But this involves the use of expensive machinery or other apparatus, and is not suitable for an ordinary person who merely wishes to enjoy the lusciousness of fresh fruit a few weeks longer than he would otherwise be able to do.

A LITTLE TOY CANNON

THE idea of loading a cannon with a seidlitz powder seems funny. Of course, our cannon will not be a real cannon; it will be an ordinary pint or quart bottle. And we need not be afraid that we shall shoot ourselves or anybody else when we discharge it, for it is quite harmless.

First, we take a bottle and put sufficient water into it so that when it is turned on its side none of the water will run out. This means that the bottle will be about one-third full. Into the bottle we put the powder that we shall find in the blue paper of a seidlitz powder, and we shake the bottle so that the powder will dissolve properly. Now we take a piece of paper, and, by rolling it round a lead pencil, make a paper tube from two to three inches long. We close the tube at one end, either by plugging it with a cork, with another small piece of paper, or simply by folding the end over a little and fastening it with a small pin.



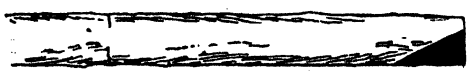
The seidlitz-powder cannon. The lower picture shows how the powder is fixed.

Then we take a cork that fits the bottle tightly, and, having tied a thread to the upper, or open, end of the paper tube, we fix the other end of the thread into the under side of the cork by using a pin. The thread should be of such a length that when the cork is put into the bottle, the tube will be about halfway down the bottle inside and just floating above the surface of the water in the bottle.

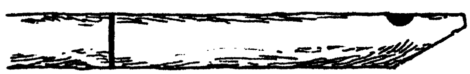
We now put into the paper tube the contents of the white paper in a seidlitz powder, and put the paper tube into the bottle, and then push the cork in tightly. All that we need to do now is to lay the bottle on its side on a table or chair. Presently our cannon will fire itself. As the water gets into the tube with its powder, it will fizz, and the force of this will send out the cork with a bang. The experiment is perfectly safe, but we must stand to the side and not in front of the bottle. It is well to perform this trick out of doors.

A WHISTLE THAT A BOY CAN MAKE

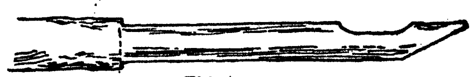
WHEN we are in the woods in springtime or early summer, we can make a good whistle easily and quickly. All we need is a knife and a thin piece of green sycamore or willow that we can cut from a bush or tree. The method of manufacture is simple. First we cut off the wood, selecting a piece with nice, smooth bark, and as nearly round as possible. It should be four or five inches long. Cut it straight across one end, and then at the same end cut a slanting piece off, as seen in picture 1. That makes the lip of the whistle. Now we make a notch at the top side of the lip, as seen in picture 2. We then cut a ring round the bark only, down near the other end.



1. First stage.

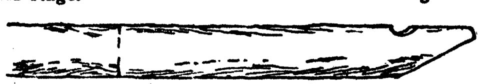


2. Second stage.



3. Third stage.

Now we take it and moisten the bark all round, either in a stream or pool, or in the mouth. Using the knife like a tiny hammer, we beat the bark all round and up and down with the handle of the knife, moistening the bark several times as we do so. We should beat it gently with the knife, and not hard enough to injure the bark. When we have done this we shall find that the bark can be slipped off in one piece right from the ring that we made to the point of the stick where the lip is. The surface of the stick, when we have removed the bark in this way, will be smooth, with a transparent and somewhat sticky fluid adhering to it. That fluid is the sap of the tree; and if it were not for this sap flowing up the tree under the bark as the tree grows, it would die. We wipe off the sap, and then, with the knife, we enlarge the notch that we have made by cutting away a piece of the wood lower down, as seen in picture 3, which shows the piece we should cut away. Now we cut a very thin strip from off the top of the stick between the notch and the pointed end, or lip. Our whistle is now made. All we have to do is to replace the bark that we took off in one piece, as we see in picture 4. The whistle should now work perfectly, giving a clear, shrill note when we blow into it. If it does not quite work well, we may discover that the notch was not enlarged sufficiently, or that we did not cut away enough of the top of the mouthpiece. Let us remedy these defects if they exist, and see if the result is better. If we are entirely successful, we may become more ambitious, and try to make a whistle giving several notes on the scale, thereby making a musical instrument that can play simple tunes. For this larger instrument we need a little longer twig, say about nine inches long, and before loosening the bark we must cut several round holes that extend farther down the stick. Then, when we have removed the bark, we must extend the notch right down past all the finger-holes. We must handle the larger instrument when it is made very gently indeed, for it is easily broken.



4. The completed whistle.

A LITTLE VEGETABLE GARDEN

WHAT TO DO AT THE END OF JULY

WHEN we gather vegetables we ought to know the quantity that will be required, so that we do not take too many. Of course, the surplus can be used next day, but they will not be nearly so nice as they would be if they were freshly cut. In fact, when people say, as they often do, that home-grown vegetables are so much nicer than bought ones, it generally means just the difference that this absolute freshness implies. Even in lifting the early potatoes, only sufficient for the day should be dug up. Always dig up potatoes with a fork instead of a spade, as the spade will probably cut several of them in pieces.

The same rule applies to lettuces or radishes; never cut more than are required for the next meal. In the northern districts of the country a small sowing of cabbages may be made during the last day or two of the month, but in warmer districts the end of the first week in August is a better time for the work, as we do not want the plants to get too forward before the cold weather.

We must see that growing crops are well watered, and keep down the weeds. This is rather a slack time in the garden, so that any work that will keep us forward during a busier season may now be done. Thus, there are our pots and pans. These may have become green or otherwise soiled on the outsides; they should have a thorough scrubbing, and then be allowed to dry. Cleanliness in all gardening operations counts for much, and clean pots are especially desirable. We must never put soil into a wet pot. If we mean to take cuttings of geraniums in greater quantity than we have pots for, we may use boxes, and pot the plants later.

We may not have any potting to do at present, but we may consider here the proper way to pot a plant. We take, then, a clean, dry pot, and we put in the pieces of broken pots that are to form the drainage. Often the novice in gardening will make the mistake of not supplying sufficient drainage. We ought to put in two or three or four pieces, and more if the pot be a very large one. Then over the drainage we lay a morsel of moss, or quite old straw manure, so that the soil does not get down between the crocks and clog the drainage. On the top of this we put the soil—a portion of it first; then we arrange the plant so that it is quite in the centre of the pot, adding the rest of the soil, and pressing it firmly about the roots of the plant. But we must *not* fill the pot with soil level with the brim; we must leave half an inch or more, according to the size of the pot, so that, when we water, we may really pour the water *into* the pot, which we could not do if it were filled to the brim with soil. This is quite an important little matter.

Perhaps we have bought, or made, a small garden frame. Such a frame is very useful, especially during the winter, when it will give capital protection to young lettuce plants, the seed of which we shall soon be sowing. Now is the time to give a coat of paint to the frame, as this helps to preserve the woodwork from rain and weather.

To return to our flower garden for a moment, there is a piece of garden work that is often required, but which has not yet been described. Let us suppose we have a fine young rhododendron, of which we have tried to strike a cutting and failed. Let us try another method of procuring a young plant from it. We will *layer* a piece to see if we can induce it to root. We make a slanting cut in a branch that is near the ground, making the cut close under a joint, being careful not to cut the branch through; then we lay it along the ground and cover it firmly with extra soil, the branch still, of course, being unsevered. In due time roots will be formed, and, when thoroughly established, we may cut it free and transplant it. But, whereas the rhododendron requires a couple of years before severing, the carnation in our border can be layered at this very season, and by the beginning of October it will be ready to transplant; but then one is a hard, woody branch, the other a soft, juicy stem. The branch or stem being layered should be firmly pegged to the ground before being covered with soil: a hairpin is often used to peg carnation layers.

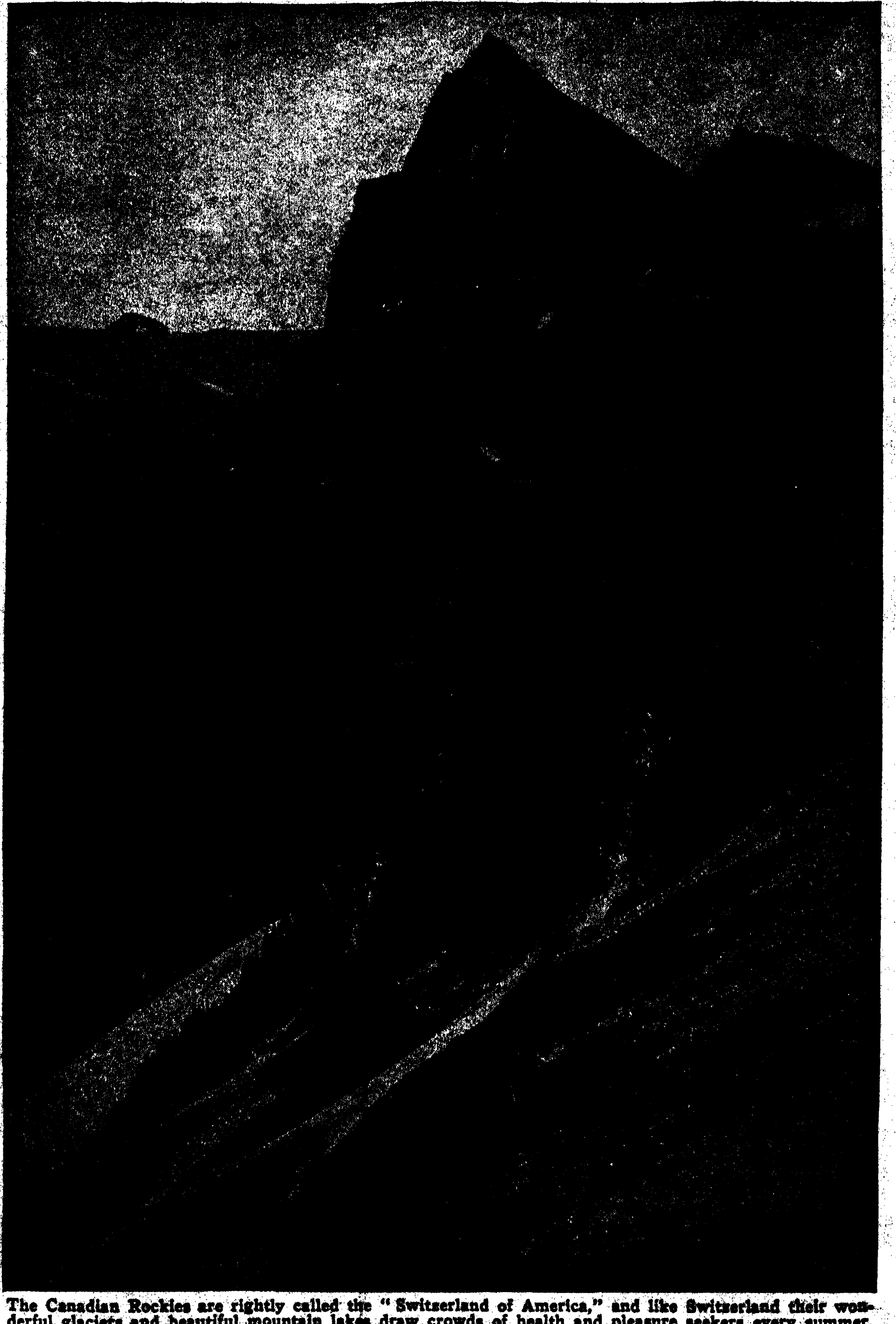
HOW TO SLEEP

WE should all know how to sleep, for there are several rules which often make all the difference to the value of sleep, or to our getting any sleep at all. For instance, it is not good to sleep on the back. There are many reasons for this, but all we need know is that sleep on the back is more liable to be disturbed in various ways, including nightmare, than sleep on the side. The heart comes nearest the surface on the left side of the body, and also the stomach is mostly on that side, so most people find that they sleep best on the right side, and many people cannot sleep at all on the left side. Another good rule for practically everybody is to go to bed to sleep, not to think or to read, and to get up in the morning when called. Always have plenty of ventilation in your bedroom. Open all the windows wide, and get all the outdoor air that you can even when sleeping. Have enough covering on your bed so that you will not take cold. Go to bed each night with pleasant thoughts on your mind, sleep in a room with plenty of good fresh air, and you will surely feel bright and rested when you awake next morning.

Sleep, you know, is a very good medicine. The energy expended during the day is renewed during the hours of sleep, and the tissues of the body, exhausted by work, are refreshed after a restful sleep. It is well to get all the sleep that you can. You have heard the old adage, "Early to bed and early to rise, Makes a man healthy, wealthy, and wise."

THE NEXT THINGS TO MAKE AND TO DO ARE ON PAGE 3959.

IN CANADA AMONG THE CLOUDS



The Canadian Rockies are rightly called the "Switzerland of America," and like Switzerland their wonderful glaciers and beautiful mountain lakes draw crowds of health and pleasure seekers every summer. There are fine hotels at Banff, at the Great Glacier, at Yoho Valley, at Lake Louise and many other interesting spots, where the people gather to enjoy the sports of fishing and boating and mountain climbing, such as can be found nowhere else save in Switzerland. In spring the slopes are covered with flowers.

WHAT MADE THE MOUNTAINS?

CONTINUED FROM 3781

I THINK we ought to say what made and what *makes* the mountains. This question is a very important and good one, but the way in which it is asked suggests just that greatest of all errors about the history of the earth. When we say "What made the mountains?" it sounds as if they had been made in a day, once for all, and that was the end of it. Mountains are being made and unmade to-day as they have been for ages past, and as they will be for ages to come. The forces that made and make them are the shrinking, and therefore wrinkling, of the earth's crust as it settles down upon the contracting interior.

If we look at the folds on the skin of a shrunken apple, we are undoubtedly learning something about the way in which mountains are made. But that is not nearly the whole answer. It may be that, to a greater extent than we have ever thought before, mountains are piled up and forced up from below in a way which is perhaps not so very different from the making of volcanoes. We can only say again at this stage that we are just beginning to guess what is the work done by radium in the rocks that make the earth's crust. We may be certain before long that radium is one of the makers of mountains.

WHY, WITH SNOW FALLING ON THEM, MOUNTAINS BECOME NO HIGHER

Plainly, something must happen to the snow which falls on such mountains, or they would be bound to grow higher, as this statement suggests. Anyone who raises such a thoughtful problem deserves to get a good answer, and it is a pity that so many similar thoughtful questions cannot yet be answered as well as this one can. As new snow falls on the old, the old is pressed from above, and it tends to slide by its own weight down the mountain.

In this way it is very tightly squeezed into ice, and though we think of snow as a light thing, yet a mountain-cap of ice, many feet thick, has, of course, a tremendous weight. As it slowly sinks down the mountain side, it makes a bed for itself, just as water does when it runs along the land; and so there is formed a river of ice which we call a glacier. The glacier may run into the sea and form icebergs, or it may melt when it gets low enough upon the mountain side. Some of the snow, but only a small amount, may form into avalanches, and so be disposed of. So we see that the snow that falls on a mountain shares in that endless circulation of water—from sky to earth and sea, and back to sky again—which is certainly going on everywhere.

HOW ARE VOLCANOES FORMED?

This is a question which has already been referred to more than once in this book, but it is also just one of those questions about which men are learning new things almost every year. We can be quite

certain that volcanoes are made by the heat inside the earth. The real questions are: Why does that heat behave as it does? and Is that heat made in any special way when the volcanoes are formed? It is certain that, at its very beginning, a volcano is a hole that is broken in the surface of the earth's crust. Once that hole is made we can understand how the heat underneath goes on using it in future; things naturally find their way out through it, because it is the "path of least resistance," and so a pile of stuff is heaped up round it, and a volcano is made.

But the whole earth is hot. Why did the hole, in the first place, form just there? There are, I think, two answers. The first is that probably the earth's crust at these places is thinner or weaker, or made of material that can more easily be pierced; and, also, as we are just learning, possibly special sources of heat and power lie underneath it, owing to the presence of rocks or materials which contain more than their share of the wonderful element radium, or some other heat-producing element like it.

WHAT MAKES THE ROOTS OF TREES GROW IN THE GROUND?

The use of the roots of trees lies in the ground. They serve, first, to give the tree a firm hold, so that the wind shall not upset it. And they are the mouths of trees, as we might say, for a great deal of the food of the tree, which it cannot do without, is sucked up into it out of the ground by its roots. On the other hand, the roots contain no chlorophyll — the green stuff by which the leaves use the light—and so there is no need for them to be exposed.

All this is easy to find out and to understand, but it does not quite answer the question. We know why it is good for the tree that its root should grow into the ground and not into the air, but that does not tell us *how* the roots know in which direction to grow. Certainly gravitation helps them. It does this, not merely by pulling the roots into the earth—for roots strike sideways and very little straight downwards—but it helps by letting the roots know or feel where the earth is. Mr. Francis Darwin, the son of Charles Darwin, who showed how the countless kinds of living creatures have come upon the earth, has proved that plants seem to know where the earth is. They have a gravitation-sense, just as we have a light-sense or a sound-sense, and this helps to guide the roots to grow downwards. Also, the roots grow at their tips, where they get their food in the soil, and so they grow in many directions just where they find the food upon which they live. We can understand how the growing tip of anything will grow towards its food.

WHY IS IT THAT TREES GROW STRAIGHT?

If a wind blows steadily, or usually blows in one direction, it may bend a tree. Or if the tree grows near a wall, say, so that the light strikes it unequally on the two sides, it may grow crooked; but a tree usually grows straight because that is the best way for it to grow, and because everything helps it to do so. There is much less strain on its roots if it grows straight and its roots grow about equally in all directions through the ground, and so help to keep it in that position. Also, a tree throws out branches about equally on all sides, so that their weight all round the trunk helps to balance it and keep it straight.

Trees that are able to grow straight upwards are the likeliest to thrive, because growing straight means that there will be space for branches with their leaves on all sides, and so the tree can use more sunlight, and is better fed. There are thus, as a rule, many reasons why trees grow straight. Some of them, like those about the balance of the branches, are what we may call mechanical reasons, and others are deeper reasons depending on the way in which the tree lives, and the way in which, like every living creature, it tries to adapt itself to the conditions of its life, so as to live as well as possible.

WHY DO THE BRANCHES OF TREES GROW SIDEWAYS INSTEAD OF STRAIGHT?

Here, again, our best way of understanding why the living creature we call a tree behaves as it does is to find out the use to which it puts its branches. We find that they exist in order to bear the leaves by which the tree breathes, and by which it also feeds on the carbon dioxide of the air under the influence of the sunlight. It is the tree's business, then, to grow its branches in such a way that the leaves they bear shall be exposed to the sunlight as fully as possible, and

so that they may produce as many leaves as possible that can be useful. Therefore, the tree throws out its branches fairly equally on every side, and in growing sideways all round they are thus best arranged to expose to the sun's rays the leaves they bear.

DOES THE EARTH TRY TO DRAW THE BRANCHES OF TREES DOWNWARDS?

Of course, gravitation is all the while trying to pull the branches downwards, and in some trees the branches bend down a good deal, especially if the tree is old, and does not get enough good food from the soil. But the tree does its best to support its branches in their sideways position, which is best for their use, though it is, so to say, a "tiring" position to be held in. I mean that it needs much force of some kind to hold the branches this way.

If we try to hold our own arms out sideways for ten minutes, we shall realise how great the pull of the earth on them is, and how inconvenient this position is. The tree's way of resisting gravitation is to form good, strong wood in its branches, and to make this wood grow directly out of the wood of the trunk; and in order to lighten the weight the wood has to hold up it makes its leaves very light in weight. The lightness of the leaves is thus very important for the life of the tree.

IS SMELL A WAVE IN THE AIR?

This is a deeply thoughtful question. It is the people who ask questions of this kind that help the progress of knowledge, because they are questions that show that the person has been thinking. Questions at random are much less likely to be useful. Sound, as we know, is a wave in the air; and the heat we feel when we stand in front of the fire is a wave in the air; and light is a wave in the ether, passing through the air.

If, then, these waves explain seeing, and the feeling of heat, and hearing, why should they not also explain smell? But, in point of fact, smell is not a wave in the air. The great point about smell and taste, which go together, is that they are what are called *contact senses*. They are due to the actual *touching* of the tongue or part of the nose by particles of certain kinds. We cannot smell or taste at a distance. Of course, anyone will say that that is untrue about smell, but it is not. We seem to smell at a distance when we guess where the smell comes from; but, in fact, the tiny parts of the thing that has the smell have traveled through the air and have reached the smell-part of the nose. This is utterly different from the cases of the other senses. Smell would be like hearing if we smelled a grain of musk or an open bottle of perfume in a room because the musk or the perfume started special waves either in the air or in the ether. They do not; but portions of themselves are carried through the air to our noses.

DO WE SEE THINGS IN THE DISTANCE OR THE LIGHT THAT IS REFLECTED BY THEM?

It is now possible to answer this extremely interesting question. What we see is the light that is reflected by things or that has been made by them if they are luminous things, and we see it, of course, in our eyes; or, to be accurate, at the back of our heads, in the part of the brain where we really see. Yet we feel as if we see things where they really are. It is now proved that this is the result of practice and experience, and the knowledge which we have gained by walking about and touching things.

A baby, when it begins to see and use its eyes, has no idea of distance. Its very first impressions, we can be sure, are of something in itself; then, as it discovers its own body, and uses its fingers, it learns that the things it sees are outside itself. Yet even then, for a long time, the baby will reach out its hand to things that are as far away as the moon. But we have better proof still. Persons born blind, who have received their sight after they have grown up, tell us that when first they see, they get the idea of something that is felt inside their heads. Only with practice do they learn to do what we learned to do when we were small—that is, refer to the outer world the sensations which, indeed, happen inside our heads.

WHY DO SOLID METALS LET LIGHT THROUGH WHEN BEATEN THIN?

After all, it is quite natural that metals should behave as they do, nor are metals in the least degree peculiar in this respect. Light, we know, consists of waves in the ether, and the ether is everywhere. But where matter is present too, as, for instance, the matter of the air, or a sheet of glass, or a piece of

metal, or anything else, the passage of light is in some degree interfered with. The most perfectly transparent thing we know will yet stop some light. This is true, for instance, of glass; even the best glass used for the lenses of spectacles. It is true of the purest air, as we soon discover when we climb a high mountain, and find how bright the sunlight becomes when it has to pass through a thinner layer of air on its way to us. If matter has this effect on light, the thicker the layer of matter, the greater the effect will be; and this, of course, is true of metals, as it is true of every kind of matter. The only difference is that metals offer a particular resistance to the passage of light, and so, if they are to let light through, they must be beaten very thin indeed.

OF WHAT IS GRASS MADE?

Grass is a plant, or, rather, there are hundreds of plants which are all called grasses. What we call grass in the garden or in the fields is the leaves of this plant—green leaves which play exactly the same part in its life as the green leaves of an oak-tree play in the life of the oak. The oak and the grass, like a rose-bush, are both true flowering plants, and if we take a little trouble we can soon find the flowers of the grass for ourselves. Like other green plants, the grass is made by the power of sunlight out of certain materials in the air and in the earth.

The elements that we find in grass are the same as those that we find in all other living creatures without exception—carbon, oxygen, hydrogen, nitrogen, phosphorus, and a few more. But while we remember that these elements exist in the grass and make it, we must also remember that there is another thing there which is as real as real can be, though we cannot see or handle it. That thing is energy. Grass could not exist if it did not contain energy, which is really the transformed rays of sunlight. This is true of all green plants and of all animals, too. Our bodies actually contain, and could not exist without, some of the sunlight of the past which is stored up in them.

WHY DOES A ROPE NEVER LIE STRAIGHT WHEN THROWN ON THE GROUND?

If we can imagine a rope made of sand, and if we could throw such a rope on the ground, then it would lie straight. The trouble is that one cannot make a rope of sand. The making of a rope at all depends upon something which will always prevent us from throwing the rope so that it will lie straight when we have made it. We can only make a rope of anything that will hang together if there is some kind of pull between the atoms and molecules that make it. If there is no such pull together there cannot be a rope.

If we take a shovelful of sand and throw it out from us, it will fly out in quite straight lines; but when we throw out a rope we are throwing out something of which the molecules are wonderfully bound together in ways which are, at present, far beyond our understanding. Their pull on each other prevents the rope from flying out in a straight line. Perhaps this would not be so if it were possible to make a perfect rope, of which all the parts pulled equally and truly and evenly, and if we could throw this rope out in such a way as to give no bias, or favor, to any part of it—a thing quite impossible to do.

IF A FEATHER IS LIGHTER THAN AIR WHY DOES IT EVER SETTLE?

Nothing is more certain than that if a feather were really lighter than air, it would never settle. If a feather in time *does* fall to the ground, it must be heavier than air, whatever we may think at first. This is indeed the case. If we were to take all the matter composing a feather, and put it together again in a slightly different form—not the wonderful form that Nature has made it—then it would drop at once

The business of the feather is to serve the life of a creature that flies, and therefore Nature has made it as light as possible. It is made of a texture that will itself hold air, and it is also spread out in such a way as to take the utmost possible advantage of the supporting power of the air. Yet, like many other things which the air will support for a time, the feather is heavier than the air, and therefore if the air is still, the feather must fall. It falls under the force of gravitation. If the air, however, is thrown into motion by the wind, its motion endows it with a force which may be greater than that of gravitation, and so the feather may be lifted from the ground into the air. Thus, it is all a question of the balance between one force and another.

IF WE WENT UP IN A BALLOON ABOVE THE AIR SHOULD WE BE ABLE TO HEAR?

Of course it would not be possible to go in a balloon above the air, because it is the air that supports the balloon which, without it, must instantly fall to the earth by gravitation, as we should fall if we tried to swim in an empty swimming-pool. But it is very interesting to ask whether a sound could be heard beyond the limits of the air. The answer is certainly not. Beyond the limits of the air there is only the ether, and though the ether carries light and heat it cannot carry sound, which is always made of waves in material things, like air or water or wood.

The English poet Tennyson has put into the mouth of one of the greatest of Latin poets some lines so perfectly beautiful that we should know them. The Latin poet, Lucretius, is supposed to be saying that the false gods that men believed in in his day lived in the spaces between one world and another, and could, therefore, know nothing of our sufferings and thoughts. They inhabit, he said,

The lucid interspace of world and world,
Where never creeps a cloud or moves a wind,
Nor ever falls the least white star of snow,
Nor ever lowest roll of thunder moans,
Nor sound of human sorrow mounts to mar
Their sacred, everlasting calm.

WHY IS YAWNING INFECTIOUS?

Well, said the Wise Man, this is a question to which I think I have found the answer myself. I firmly believe the reason why yawning is so intensely infectious depends upon the nature of yawning. The first and most urgent necessity in the lives of all of us is to breathe. A yawn is a very deep breath. It depends, as a rule, upon the fact that from one cause or another—it may be that we are bored, or it may be that we have some illness—our breathing has fallen below what is needed, and the yawn is an attempt to make it up.

Now, it is a very well-known fact that one human being can affect another by what is called suggestion. A boy sees another boy eating a chocolate, and of course he wants a chocolate; one person sees another person afraid, and then he becomes afraid; if everyone around us is laughing and happy, we begin to laugh and feel happy; or if they are all in the dumps, we get in the dumps too. I believe that we can discover a great principle here. It is that suggestion is the more powerful the nearer the suggested thing is to the needs of life. That, for instance, is why the suggestion of fear is so powerful, as we see when a herd of animals take fright and stampede. And yawning is more powerfully conveyed by suggestion—infectious, as we say—than almost anything else we know of, because it happens to deal with the most urgent and constant need of all life, which is to breathe.

WHICH PEOPLE FIRST WROTE BOOKS?

Writing is so important for mankind as it preserves knowledge and enables it to gather like a snowball from generation to generation, that this question is one of the most interesting in the world. But it is very much less interesting if by "books" we mean something like our books—made of paper and bound together; or even if we include in the term writing on loose sheets of anything. The real question should cover all writing; whatever it was on matters very little. Writing on paper is at least as old as 2,000 years before Christ, and it was done by the Egyptians. They made the paper from the stems of a plant called the papyrus; and, of course, if sheets of this paper are bound together, that is a book.

Long before paper was invented, men wrote on other things, and one of the commonest was clay. This could be made into bricks or into cylinders, and these were written on, hardened, and kept. To-day thousands of these most ancient of books—as they really are—have been collected in museums. We may see them in many cities. They were used first, so far as we know, by the Babylonians and the Assyrians, even before the time of the Egyptian civilization; but it is quite likely that they are older still, and that the Babylonians learned how to write "books" on clay from earlier people, who were probably the ancestors of the Chinese.

WHY ARE BLIND PEOPLE SO QUICK AT HEARING?

The simplest answer to this question would be to say that blind people listen more attentively to the sounds around them; but it will be well to explain a little more than that. An ordinary person who has all the senses of sight,

smell, touch, hearing, and taste, receives a tremendous number of impressions from all sorts of sources, which are conveyed to his brain by special nerves and give him the ideas which he identifies with all those sensations. Now, if one of these nerves, or brain centres, should be destroyed or absent, the brain has fewer messages to attend to, and so has more time for the rest.

Thus in a blind person there are no means of his getting all the information which comes to an ordinary person through sight, so that if he wants to know how near he is approaching to somebody walking towards him, the only means he has of judging that is by listening to the sound of the footstep. He cannot see the distance which separates the two. In this way he becomes accustomed to listen deeply for all the sounds around him, many of which he would otherwise not hear at all; and so we find that blind people get into the way of doing so, and, as a result, are extremely quick at hearing.

HOW DOES AN EAR-TRUMPET HELP THE DEAF TO HEAR?

If we come to think of it, what we call the ear—that is to say, the outside part—is nothing more or less than an ear-trumpet itself, only the shape is a little different; that is, the external ear is a machine for collecting the waves of sound for the ear and conveying them into the internal ear, from which they pass in turn to the nerve of hearing and thence to the brain.

In people who are deaf it is possible, by using a much larger collecting surface than the ear—that is to say, by having a bigger surface for the sound-waves to beat upon—to make the sound-waves reach the inside of the ear with greater intensity, and so stimulate the nerve of hearing. This is what the ear-trumpet does. In human beings the outer ears are not much used for collecting sound, but in some of the lower animals we can see them being used at any time; for example, in horses and dogs, which "prick up their ears," as we say, in order to catch the sound-waves. So that an ear-trumpet is just an artificial ear for collecting sounds.

WHY DOES IT NOT HURT WHEN WE CUT OUR HAIR?

We feel pain when we burn our fingers or suffer from any other kind of injury because almost every part of the body has innumerable small nerves in it, which carry to the brain the sensation of pain. It follows, therefore, that if there were no nerves there would be no pain; and, as a matter of fact, when a doctor wishes to do anything to a patient which would be very painful, he uses some means to deaden the endings of the nerves in the skin. Now it so happens that our hair, like our nails, has no nerves, and therefore may be cut off without causing any pain at all.

WHY DOES HAIR GROW AFTER THE BODY HAS STOPPED GROWING?

Certain parts of the body are capable of growing into certain definite shapes and sizes and no farther, whereas other parts of the body have the capacity to keep on growing as long as the body itself is alive. Thus, a bone in the leg grows to a certain size and then stops, and nothing we can do to it can make it grow any larger. On the other hand, structures which are meant to protect the body, such as the skin and hair, are constantly being worn away, and are reproduced as quickly as they are lost.

WHY DOES SALT MELT SNOW?

We are all familiar with the instrument known as the thermometer, which was invented by a man named Fahrenheit, who lived from 1686 to 1736. He found that the lowest temperature he could obtain was got from a mixture of ice and salt, and in order to make a scale to measure heat he called the temperature of this mixture 0 degree, and the temperature of boiling water he called 212 degrees.

Now, on such a scale the freezing-point of water was 32 degrees, so that we say that it is freezing when the thermometer stands at 32 degrees Fahrenheit.

When salt is mixed with ice or snow in this way, the process of mixing changes the salt, ice, or snow into a liquid, but the temperature of that liquid is considerably lower than the temperature of freezing water or snow; so that we see one of the most striking effects of heat is its power of changing the physical condition of matter.

In this particular case it changes the salt, ice, or snow into liquid; but as that liquid requires a much colder temperature to freeze it than water does, the snow is slowly melted.

WHY DO THINGS GROW YELLOW WITH AGE?

This is a question of the production of a particular coloring matter, or pigment, in this case a yellow pigment. As a matter of fact, it is not everything that becomes yellow with age. For instance, an old quarter is not yellow, which points to the fact that whether the article becomes yellow or not depends upon what it is made of.

In the case of a leaf which turns yellow in the autumn, these coloring matters, or pigments, are produced by a chemical change, the green coloring matter splitting up after a long time into others, of which yellow is one. So most things which become yellow as they grow old are yellow because of the production of a yellow pigment from some of the substances contained in them, and these things will generally be found to be composed of vegetable matter.

WHY DOES WOOD WARP IN DAMP WEATHER?

As long as a piece of wood is growing in the tree, and is alive, it contains, of course, a certain amount of moisture, and this moisture is in the fibres, which we may think of as a number of small tubes packed side by side. Now, these fibres shrink or swell up according to the amount of moisture they contain. When the tree is cut down and made into timber, a great deal of the moisture is let out and evaporated, and if the wood is quite dry it will retain its shape as long as it is so.

It is one of the difficulties in drying wood to get both sides equally dry; and we may have noticed that if we place a piece of damp wood near the fire, or if we wet one side of a piece of dry wood and hold it near the fire, the wood immediately begins to curl, owing to the wet side contracting or expanding, while the other side remains stationary. The shrinking and swelling, according to the amount of moisture present, takes place only *across the grain* of the wood, leaving its length entirely unaffected by the moisture.

WHAT HAPPENS TO SNAILS WHEN THEY DIE, AS WE FIND ONLY THE EMPTY SHELLS?

We may sometimes find, while walking along the sea-shore when the tide is low, the white bones of a bird or some other animal. And, if so, we may ask why do we not find the dead bird, but only its bones? Perhaps we may say at once that it was because the bones of the bird were harder than the rest of it, and lasted after all the soft flesh and muscle and everything else had decayed and disappeared. So it is in the case of the snail. True, the snail has not a skeleton like a bird has, because the body of a snail is a very soft substance, like that of a slug. When the snail dies its soft body is easily broken up into many different chemical substances, and all the moisture in it evaporates, and all that is left is the hard shell, which will last a long time. So that the answer to the question is simply that the harder a thing is the longer it will last, no matter whether it happens to be the shell of a snail or the bones of another animal.

WHY DOES OIL FLOAT ON THE SURFACE OF WATER?

It seems very curious at first sight that one liquid should be able to float on the surface of another; but if we think carefully about it we see at once that whether a thing floats on the surface of water or not depends upon one or two things. First, it depends upon whether it is soluble—that is, will dissolve—in water or not.

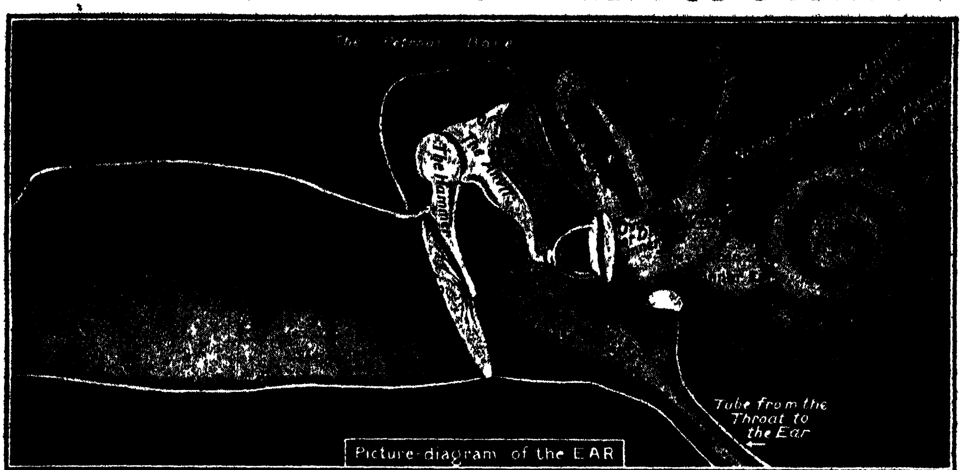
For instance, if we put a piece of salt in water it disappears, because the salt is soluble in the water. If, however, we put a piece of light wood on water it floats there, because it is not soluble, and therefore remains intact, and also because the weight of the piece of wood is less than an equal piece of water. It is much the same with oil. Oil and fat are quite insoluble in water, and as the oil is considerably lighter than the same bulk of water, it floats on the surface.

WHY DO SMALL THINGS FLOATING ON WATER MOVE TOWARDS LARGE THINGS?

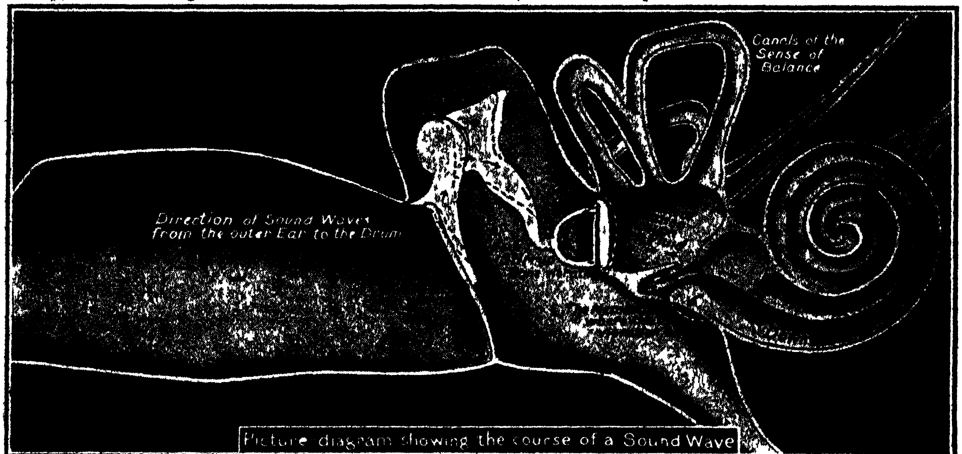
The reason why small bodies floating on the surface of water are attracted to larger bodies is that, by the law of gravitation, any large body attracts in its own direction any smaller body, whether the two are floating in the water or whether they are in any other surroundings. Only if they happen to be in water it is easier for the power of attraction between the two to cause the smaller body to move towards the greater, because water is a mobile fluid and can be displaced easily by anything which moves through it.

THE NEXT QUESTIONS ARE ON PAGE 4017.

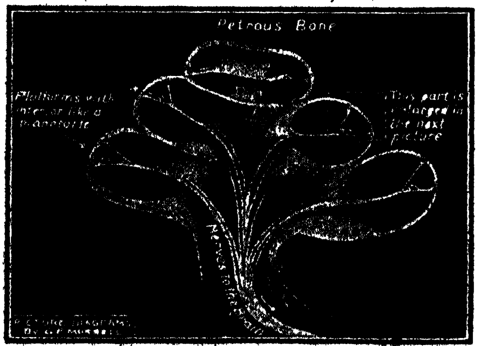
THE WONDERFUL MACHINERY OF OUR EARS



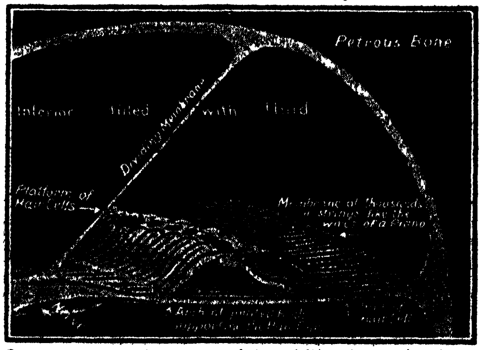
This shows the inside of our ear, from the entrance to the end of the nerve that passes to the brain. The drum is stretched across the end of the canal, and on the other side is the chamber of the middle ear, filled with air that enters from the throat. In this chamber are three small bones, the hammer, anvil, and stirrup, the last being fixed to the drum of the inner ear, which is shaped like the coils of a snail's shell.



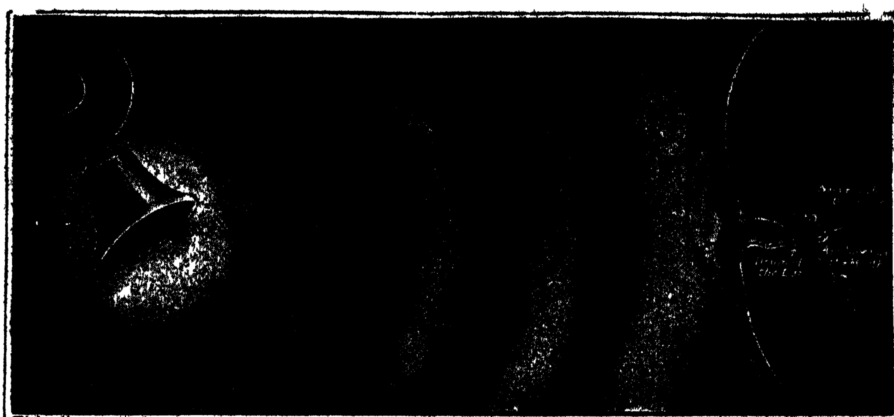
Here is a sound-wave striking the drum of the ear. The vibration moves the handle of the hammer, which pulls the anvil and pushes the stirrup, as shown by dotted lines, against the drum of the inner ear. Tiny waves of the fluid inside this inner ear pass through a membrane which lines the shell, and, traveling round the coils in the direction of the arrows, communicate sensation to the nerve, and then return by another canal.



In this picture the spiral coil is cut through from top to bottom. The galleries are filled with fluid, and contain very marvelous organs. The part in the dotted square is shown enlarged in the next picture.



Over 3,000 tiny hammers, jointed like those of a piano, support thousands of hair-cells that rest on a membrane. More than 10,000 strings are stretched across, like piano wires, and these convey the wave sensation to the nerve.



This diagram shows us how sound-waves travel in increasing circles and how the outer ear collects the waves, shown by the arrows A, B, C, directing them inwards so that they will strike the drum.

THE MARVEL OF HEARING

CONTINUED FROM 3822

We know something of the brain and the spinal cord, which together are called the central nervous system, in the upper part of which the Self of man resides. But when we study the history of the central nervous system, we find that it has been developed from the surface of the body, and this fact in itself argues—as all the other known facts do—that its first business is to receive communications from the outside world.

At the present time these communications take very definite lines, which we call the senses. It is by the senses that we gain all our knowledge of outside things, and it is upon the delicacy of the senses that, in the first place, the high development of the human being depends.

We have reason to believe that this delicacy is, in the main, a matter of the brain itself, rather than of the channels from the world to the brain. But, in any case, it must be distinctly understood that this quality of sensitiveness is so invaluable that all the higher qualities of mankind are built upon it. It is, no doubt, possible to be unduly sensitive—sensitive to a degree that upsets the balance of the mind; but, then, nearly every good thing can be exaggerated. We hear so much to-day of people being too sensitive that it is worth while to remind ourselves how valuable sensitiveness really is. John Ruskin long ago pointed out, by observation of men and women, what we can prove by examination of the body—that delicacy of the senses is the foundation on which are built all the highest and best developments of human character.

One of the most horrible consequences of what we at present call education, and of the dull routine through which so many of us are put, is that the beautiful delicacy of sense that enables children to respond to what is new, and to notice small differences between things, becomes spoiled; the edge is blunted, so that many people go through the world having lost, when they were children, the sense of appreciation of the things which make it such a beautiful, wonderful, and interesting place. Some day, when we learn what human beings really are, we shall find better ways than those at present adopted in educating and dealing with children, and then we shall get better results.

And, now, having said so much, let us go on to study, one by one, our

senses, or highways of knowledge. It probably does not matter very much with which sense we begin, for the great principles are the same in every case; only we may begin by noting the names of the various senses, and especially by distinguishing—as people usually do not—between the senses which communicate with the outer world and certain other senses which do not.

THE SENSES BY WHICH WE KNOW THE OUTER WORLD

The senses which communicate with the outer world are—seeing, hearing, taste, smell, and touch. But nowadays we have learned that it is not sufficient merely to say touch, for there are several senses in the skin besides mere touch. We must at least add the heat sense, the cold sense, and the pain sense to the sense of touch.

In addition to these senses which communicate directly with the outer world, there are other senses by which the brain is informed about the body. Of course, in a way, we may say that, so far as the brain itself is concerned, the body is part of its outer world. These senses come from the organs inside the body, from the muscles and joints, and from certain wonderful little canals in the inner ear, which we shall study later.

Now we can take the senses one by one, and we shall begin with hearing. We know that there is a special part of the brain concerned with hearing. If we were to use the word ear for the part of the body that really hears, we should certainly have to say that the real ear is in this part of the brain. The ordinary ear is on both sides of the brain, and the ear for music, as we say, is probably on the left side only in right-handed people, and on the right side only in left-handed people, though in great musicians the sensitive ear for music may perhaps be developed equally on both sides of the brain.

THE REAL EAR IN OUR BRAIN THAT CANNOT HEAR AT ALL

But we are quite certain that sound cannot be heard directly by this real ear in our brain. The part of the brain where we feel touch feels nothing if it is itself touched, and this is true of the senses generally. The brain only responds if the communication is made to it through the proper channel. So what we now have to study is the channel that leads from the outside to the hearing centre in the brain. Perhaps the best use of the word ear would be to describe the whole structure, from the surface of the body to the tiny nerve-cells where the hearing is actually done.

If we begin at the surface of the body, we find in ourselves and in most of the higher animals a pair of organs projecting from the head, which are the only parts of the organs of hearing that we can see, and which we therefore call the ears, though they are by far the least important part of the whole organ of hearing, especially in ourselves. We have all observed a dog prick up its ears, and so we learn that the real use of the ear—or, as we should properly say, the outer ear—is to catch waves of sound.

It is the general rule that the outer ear is provided with small muscles by which it can be moved in various directions. This serves two purposes. First, it enables the animal to make the most of the sound that comes to it, for the sound-waves are, to a certain extent, gathered up by the outer ear, and so are made more intense.

WHY ANIMALS PRICK UP THEIR EARS AT ANY SOUND

But the second great advantage of being able to move the outer ear is that it greatly helps to decide where a sound comes from. This is of great importance to such an animal as the antelope, which hears a sound and fears that it is the voice of a lion. We all have opportunities of observing how animals prick up their ears, and we can imagine them saying to themselves: "Where-ever does that sound come from?"

It is very interesting to find in ourselves three little muscles attached to the outer ear, by which it ought to be pulled in various directions. These muscles exactly correspond with those that we find in the lower animals, but in ourselves they have quite fallen out of use. Though they are small, they are still quite capable of moving the ear; but we do not use them. A few people have the power of moving one or both outer ears at will, but there is no record of any human being who ever moved his outer ears when he was straining to hear a sound, or when he was trying to judge the direction of a sound.

We are able still to judge the direction of a sound, but we cannot do so any-

thing like so well as the lower animals, and the reason, no doubt, is that our outer ears no longer help us. Still, we are able in some degree to compare the intensity of a sound in the two ears, and so we judge more or less where it comes from. If the sound is made at a point equally distant from both ears, we are quite at a loss. A simple and amusing experiment or game will prove this.

AN AMUSING GAME THAT TEACHES US A LESSON IN SCIENCE

If someone is blindfolded, we can seat him in a chair and then make little noises, and ask him to judge where they come from. As long as they are on one side he will judge all right; but if we make the noises at the back of his neck, in the middle line of his body, or under his chin, he cannot tell the one from the other. Of course, we must not allow him to guess in other ways, as by the noise of our breathing or the warmth of our fingers; but we must ensure that it is a pure test of answering correctly the position of the sound. We shall then find that he cannot distinguish between a sound made at the back of his neck and a sound made under his chin.

If we try this experiment on one of those people who can move their ears, we shall find that he does not use his power for this purpose. But one of the lower animals could not possibly be deceived in such a case. By pricking its ears forwards and back, it would in a moment discover in which direction it heard the sound best. It would have no more difficulty in this case than when the sound was on one side. When the sound comes from the side, the animal judges, as we do, mainly by comparing the intensity of sound in the two ears.

THE CENTRES OF HEARING IN THE BRAIN THAT COMPARE NOTES

This seems very simple, and none of us has any difficulty in doing it; but it is wonderful, all the same, that the two hearing centres should be able to compare notes, so to speak, and when the left hearing centre hears loudest we should turn to the right, and when the right hearing centre hears loudest we should turn to the left. This is so because most of the nerve-fibres cross the middle line of the body on their way to the brain.

The outer ear is not entirely useless even in ourselves, for if it is all filled up except just at the opening of the canal that runs inwards, we hear less clearly. This experiment can easily be made. It shows us that to some extent the outer ear is still useful as a sort of ear-trumpet, though vastly inferior to that of most of the lower animals.

From the outer ear there leads a little channel, called the canal, along which the sound-waves pass. When we cleanse our ears, we cannot and do not wash this channel. It would be a very serious matter if we had to do so, for there would be grave risk of doing harm at its inner end. Yet, as a rule, the channel is kept perfectly clear and open, even though it is never washed. It is lined by tiny glands which produce a sort of wax, and as this wax passes outwards it carries impurities away with it. We think of this wax as a rather unpleasant thing; but, in reality, it is a beautiful means of cleanliness and protection. At its inner end the canal is closed entirely by a piece of thin, delicate membrane, which is exactly like a drum-head, and it is called the drum of the ear, or *tympanum*.

THE GREAT IMPORTANCE OF THE DRUM OF THE EAR

This drum is exceedingly important for the purposes of hearing, and it is a delicate thing. If it is injured, it is, as a rule, injured permanently, and the hearing is affected. It may be injured either from within or from without. Sometimes little children push beads or peas into their ears, and they may do much harm in that way. A child might have reason to regret for its whole life such a foolish action. When anything like a bead has been got into the ear, we should call in the doctor at once and not attempt to get it out ourselves.

This precious drum of the ear is also liable to be injured from within; and ear-ache in children, or indeed in anyone, should not be neglected, because it means, as a rule, more or less of a threat against the health of the ear-drum. We shall understand this better when we see what is on the inner side of this drum.

If we could see beyond the ear-drum, we should find that it made one of the walls of a little space, or chamber, hollowed out inside one of the bones of the head. This space is known as the middle ear. The bone in which it, and also the inner ear, lies is called the petrous bone, from the Greek word for a rock,

because it is the hardest bone in the whole body. This is interesting because a hard bone must undoubtedly conduct waves of sound very much better than a softer one.

THE LITTLE TUBE THAT RUNS FROM THE THROAT TO THE EAR

This middle ear is filled with air, and naturally we must ask where the air comes from; the answer is that it comes from the throat. There runs from the back of the throat on each side a little tube which goes to the middle ear and conveys air to it. If we shut the mouth and hold the nose, and then make a sharp movement as if we were sneezing, we can feel something happening in our ears. This is because when we made that movement we opened the little tubes, and drove some air along them into the middle ears. It is a very important thing for the safety and health of the ear, and also for the immediate purposes of hearing, that the air-pressure on both sides of the drum of the ear should be the same.

If the air-pressure were greater on the outside than the inside of it, the drum of the ear would be driven inwards and strained. If any disturbance in the throat or nose closes up these canals, so that air cannot get along them, this is liable to happen. It is said that when we go quickly down the shaft of a mine it is wise to make a swallowing movement a few times, because in swallowing we open the canals from the throat to the ear. The pressure of the outside air increases as we go down, and the drum of the ear is apt to be strained unless we open these little tubes and thus allow the air-pressure on both sides of the drum to remain the same.

WHY A COLD IN THE HEAD CAUSES DEAFNESS

Everyone knows that a cold in the head often causes deafness. The reason is that the cold, as we call it, spreads along the tubes that run to the ear. The lining of them becomes swelled up, and so they are closed, and cannot do their duty of keeping the air-pressure of the middle ear the same as the air-pressure outside. Hence the drum of the ear is strained and cannot vibrate as it should to sound-waves, and so we are deaf for the time. In more serious troubles of the nose and throat, such as may happen in scarlet fever, the middle ear may be invaded by the disease, and the drum of the ear may be broken through, and deafness for life is the result. It is probably quite fair to say that proper care and treatment from the first could prevent this very unfortunate result in every case.

But the most remarkable thing that we find in the middle ear is a little chain of three tiny bones, much the smallest bones in the body, which are there for a very special purpose. There is a picture of them on page 3912. They are called by Latin names, which mean the hammer, the anvil, and the stirrup, and the stirrup especially is exactly like its name. The handle of the hammer lies against the drum of the ear; the hammer is jointed to the anvil, and the anvil to the stirrup, and the foot of the stirrup lies against another sort of drum which leads to the most wonderful place of all—the inner ear.

HOW THE HAMMER, ANVIL, AND STIRRUP CARRY SOUNDS TO THE INNER EAR

The business of this chain of bones is to carry sound-waves across the middle ear. That is why it has to be filled with air, for otherwise they could not vibrate freely. Every time a sound-wave causes the drum of the ear to vibrate, it sets in motion the hammer bone which is fastened to it, and so the vibration goes on. If the joints between the bones become fixed, the hearing is spoiled in some degree. This may happen in old age.

Lastly, we find two muscles, very tiny but very useful, which pass into the middle ear. They have opposite uses, and we call them into action—though we know nothing about it—according to whether we want to hear a sound more acutely or less acutely. One of them is so arranged that when it pulls it tightens the drum of the ear. That makes the drum vibrate more energetically, and so we hear better. Whenever we strain to hear, we throw this little muscle into action. It is called by doctors the *tensor tympani*, which simply means the stretcher of the drum.

The other muscle has just the opposite effect. It is attached to the stirrup bone in such a way that when it pulls the bone cannot vibrate as well as usual. So when this muscle is in action it interferes with the conduction of sound to the inner ear, and when a noise is unpleasantly loud we throw this muscle into action. It is noticed that in certain

cases when there is anything the matter with the nerve that supplies this muscle, loud sounds become unusually painful.

That is all we need say about the middle ear. The more closely we study it, the more wonderful we find it, and we become almost inclined to think that there can be nothing quite so exquisite and perfect in the whole body until we come to study the inner ear, compared with which the middle ear is almost clumsy. The whole purpose of the chain of bones in the middle ear is to carry the sound-waves from the drum on its outer wall to a similar sort of membrane on its inner wall, on the inside of which is the inner ear. The inner ear is filled with fluid, and every sound that we hear reaches the nerve of hearing by conduction through fluid.

We think of sound as a wave in the air, and that is what it usually is ; yet in its last stage, before reaching our nerves, every sound we hear is made of waves in water. This has a special interest if we trace the history of the ear and notice how it has slowly developed from its early stages in the fish, which hears sound-waves conveyed by water.

THE INNER EAR THAT IS FAR MORE WONDERFUL THAN THE OUTER EAR

The main part of the inner ear is a tiny and very delicate bony structure, shaped almost like a snail's shell. In the picture on page 3912 it is cut right through, and shows us how the canal is arranged in a spiral. We must understand that all this is filled with fluid. When the foot of the little stirrup bone is thrown into vibration by a sound, it vibrates the membrane to which it is attached, and so there is started a series of rapid little taps to the fluid which is lying against the inner side of that membrane, and the waves thus started run right along this spiral coil.

Now, when we carefully examine the inside of this coil with the aid of a microscope, we shall find that we have really come to the essential part of the machinery by which sounds are received. All the rest that we have studied is merely for conducting the sounds. The outer ear, the canal leading from it to the drum, the chain of bones, and the spiral canal filled with fluid, are only arrangements for conducting the sound in the best possible way to the ends of the nerve of hearing. We may compare all these parts of the ear with all the front parts of the eyeball, which we are going to study in a short time. These front parts simply serve to carry the light to the curtain at the back of the eye, where the nerve of vision begins or ends, whichever way we care to look at it. And the same is the case with the ear.

THE FIBRES OF THE INNER EAR THAT ARE LIKE PIANO WIRES

But we have not yet actually reached the ends of the nerves of hearing. The little nerve-fibres do not hang freely in the fluid of the spiral canal, for there is something in between. We find that along the whole length of the canal, stretched across it from side to side, there is a sort of platform made of delicate fibres. Their number runs into many tens of thousands. The canal becomes narrower as it reaches the top of the spiral, and so these fibres grow shorter.

If the spiral were arranged flat, in a straight line—which it doubtless would be but for the fact that a spiral takes up less room in the head—we should see that the fibres are very like a series of piano wires, or like those toy musical instruments made of strips of metal that are struck with little hammers. Many people suppose that there is a meaning in the resemblance of these fibres to a musical instrument.

We know cases where people have been perfectly deaf to one or two notes of the piano, but could hear all the notes above and all the notes below, and in some of these cases it has been found that the piano in the inner ear, so to speak, has been damaged in a way corresponding with the gap in the person's hearing.

THE LITTLE FINGERS OF THE EAR THAT RECEIVE THE WAVES OF SOUND

Now, upon the whole length of this series of fibres there are perched a number of small but wonderful cells, each of which has a few little things like short hairs sticking out from it, and these little fingers, or hairs, lie in the fluid of the spiral canal. Probably it is these tiny, hair-like fingers that receive the waves of the fluid, and then something happens in the cells. Lastly, if we examine carefully the lower part of each of these cells, we find that the nerve of hearing, which has come to this place from the brain, has sent a few tiny fibres

that end at the base of these cells. The fibres do not run into the cells, but the cells are, so to speak, perched upon the ends of the little nerve-fibres.

THE JOURNEY OF A SOUND FROM THE OUTSIDE WORLD TO THE BRAIN

Now we have actually traced the sound from the outer world to the ends of the nerve of hearing. We have seen the path of its conduction, sometimes along canals filled with air, sometimes along little bones, then along the canal of fluid, and, lastly, through their hairs into certain special cells made for the purpose. Here we come to a point which very few people understand, and as it applies equally to all the senses, we must know it thoroughly. We might suppose that the next thing to happen would be that the sound, having got so far, runs along the nerves of hearing to the brain. Nothing of the sort occurs.

Hitherto we have been dealing with things that are wonderful and complicated enough—so complicated that what has been said is only a mere outline of the facts—but at this point we have reached something compared with which all the rest is commonplace and simple.

The sound which reached the hair-cells of the inner ear does not pass along the nerves of hearing, but it sets up in them a nerve-current which runs to the brain. That nerve-current is not a sound-wave; it is utterly different in every way from a sound-wave. But it is that current, and that alone, which excites the hearing cells in the brain, and enables us to say that we hear.

If we examine the nerve of hearing through a powerful microscope, it looks just like any other nerve. But to say merely that it is capable of carrying a nerve-current which we translate into sound is not to state half the mystery, for we must consider the infinite variety of sounds that we can hear and distinguish.

THE MANY NERVE-CURRENTS THAT PASS TO THE BRAIN WHEN WE HEAR MUSIC

What must be the number and delicacy and variety of the nerve-currents passing along these nerves of hearing when a great musician conducts a big orchestra, and can hear every instrument separately, and know whether it be in tune or not! How delicate must be the varieties of current that are possible when we remember that it is scarcely possible for us to mistake the voice of one friend for that of another, and that, after twenty years, hearing a mere syllable pronounced will tell us that someone is present whom we have not seen for all that time!

So long as we confine ourselves to the study of the inner ear, and see the tens of thousands of fibres of different lengths, and the hundreds of thousands of hair-cells which it contains, we are not so much puzzled, because here is something which seems fitted to correspond with the powers of the sense of hearing.

There ought to be the power of noticing slight differences in sounds by means of an organ so complicated as the inner ear is. But the inner ear would not be of the least use without the nerve of hearing, and every one of these tiny differences in sounds means a tiny difference in the something that runs along the simple little white threads that serve to make up this nerve.

THE GREAT MARVEL OF NERVE-CURRENTS THAT VERY FEW PEOPLE THINK ABOUT

Language cannot say how wonderful these things appear to those who really think about them; and it is a great pity that so many of us should go through the world, hearing, seeing, and moving, and yet never giving a thought to these marvels upon which our lives depend.

The fact that nerve-currents, and not sound-currents, travel along the nerve of hearing is a general truth of all the senses. It is not light that travels along the nerve of vision. The place in the brain where we see is enveloped, and lives always in utter darkness; no light ever reaches it. What reaches it is the nerve-currents from the nerves of vision. All that the light does in entering our eyes is to do something which starts those nerve-currents in the ends of the nerve of vision.

And all that sound does in entering our ears is to start certain nerve-currents in the ends of the nerve of hearing. When we study the variety of sensations that are possible for us, we see that a nerve-current, though we talk about it so easily, must be nearly the most complicated and wonderful thing in the world, compared with which the waves of sound, or light, or electricity, must be considered quite simple.

THE NEXT PART OF THIS IS ON PAGE 3997.

WHAT THIS STORY TELLS YOU

A SPY in time of war is one who visits in disguise the territory held by the enemy for the purpose of gaining information about their plans. If he wears his uniform he is not a spy, and must be treated as a prisoner of war, but if he wears the uniform of the enemy or ordinary clothes, he is a spy and may be put to death by hanging. Soldiers think such a death disgraceful, and yet the love of their country has always led men to risk their lives to help their commanders gain necessary information, for it is considered fair to send out spies and every army uses them when needed. Here we tell of two brave men.

TWO SPIES OF THE REVOLUTION

CONTINUED FROM 3756

DURING the Revolution many spies were sent out by both sides, but two, one American and one English, have been remembered more than all the others. Both were young officers, well-educated, and lovable. Both risked their lives, were caught, and suffered disgraceful deaths while the British army held New York. Monuments have been erected to them both as you can see on another page.

NATHAN HALE, THE TEACHER AND SOLDIER

Nathan Hale was born in Coventry, Conn., June 6, 1755. Though a delicate child, he grew into a strong handsome boy whose smile made many friends. When less than sixteen years of age he entered Yale College and was graduated with honor in 1773, though only eighteen years old. For two years afterward, he was a successful teacher, but when the Revolution began he left his books, joined the army at Boston and was soon made a captain.

When Washington led the army to New York, young Hale went, of course, but we do not know much about what he did until after the American army was defeated at the battle of Long Island. Washington then retreated to the northern part of Manhattan Island. He did not know whether the British were preparing to attack him or to surround him, and called for a volunteer to enter the British camp.

Captain Hale offered to go, though his friends tried to prevent him. His answer was, "I wish to be useful; and every kind of service necessary for the public good becomes honorable by being necessary." He went to Norwalk, in Connecticut, on September 14, 1776, and crossed over to Long Island. Disguised as a traveling schoolmaster seeking employment, he visited the British camps in Brooklyn and New York and gained much information which would have been valuable to Washington.

HOW AN ACCIDENTAL MEETING LED TO CAPTURE

No one seemed to suspect him and in a few days he returned to the point on the Long Island shore where he had landed. He had given orders that a boat was to meet him there on the morning of September 21st in order to take him back to Norwalk. The night before he spent at a tavern near by, and there he was recognized by a man, who informed the British soldiers who he was. Some say that this man was his cousin, who was a Tory, but it cannot be proved.

Early the next morning he went out to meet the boat which was to take him back. A boat came, but it was a British boat, and took him to a British ship. There he was searched and notes and plans of the camps were found in his shoes. He did not deny who he was or what he had been doing, when taken before General Howe. Though the British general is said to have been much pleased with the be-

havior of the young officer, the case was plain and he was sentenced to be hanged the next morning.

The officer in charge of the execution is said to have been brutal and cruel. We are told that he refused to send for a clergyman, or to allow the young man a Bible, and that he tore up the letters Hale had written to his mother, his sisters and the young woman he was to marry. When all was ready, the young hero bravely faced death, saying, "I only regret that I have but one life to lose for my country."

A beautiful statue of the young patriot by Frederick MacMonnies stands now in City Hall Park and some think is near the spot where he gave his life for his country. Others think he was executed nearer the East River and further north.

A YOUNG ENGLISHMAN WHO LOST HIS LIFE

Now let us turn to the Englishman who also risked his life and lost it. John André, the son of a Swiss merchant of London, was born in 1751 and was educated at Geneva, in Switzerland. On his father's death he carried on the business for a time, but after a disappointment in love, entered the British army, and in 1774 came to Canada to join his regiment. He was captured in 1775 and kept a prisoner for a year. When set free he was promoted to captain, and during 1778 was with General Howe in Philadelphia.

Under General Sir Henry Clinton, he was promoted to major, and made adjutant-general. During 1779 he was with the British forces in New York, where he won all hearts by his manners and his talents.

HE MEETS A TRAITOR TO THE AMERICAN CAUSE

Meanwhile General Benedict Arnold of the American army had been placed in command of the fort at West Point. General Arnold had been badly treated by Congress. He had enemies who had delayed his promotion and attempted to ruin him. While in command at Philadelphia he had married the daughter of a wealthy Loyalist and had gone deeply into debt. Somehow, at some time, the idea of betraying his country came into his mind, and this fact was made known to the British commander.

On September 20, 1780, by order of General Clinton, André went up the Hudson in the Vulture to meet Arnold. He went ashore, wearing his uniform, and the meeting was held in the woods. The arrangements were not ended when morning came, and they rode to the house of a farmer near by.

It was arranged that Sir Henry Clinton should ascend the river and attack West Point. After pretending to resist, Arnold was to surrender the fort, and it was hoped also to capture Washington, who was then in Connecticut. For his treason Arnold was to be made a British brigadier-general and receive $50,000 in gold.

ANDRÉ IS CAPTURED WHILE RETURNING TO NEW YORK

The Vulture dropped down stream, and the farmer was unwilling to take André back. He was, therefore, forced to try to reach New York by land. Wearing an old coat given him by the farmer, he set out on horseback. He passed beyond the American lines into what was known as the "neutral ground" because both parties claimed it, though neither was able to hold it. On the morning of Friday, September 23d, a party of young Americans stopped him. André, thinking they were Tories, told them he was a British officer. After this they would not let him go, though he had a pass signed by Arnold. They searched him and found papers in his stockings which showed him to be a spy, and took him to an American officer, who, not believing that Arnold was a traitor, sent André to him.

THE TRAITOR ESCAPES, BUT THE SPY IS HELD

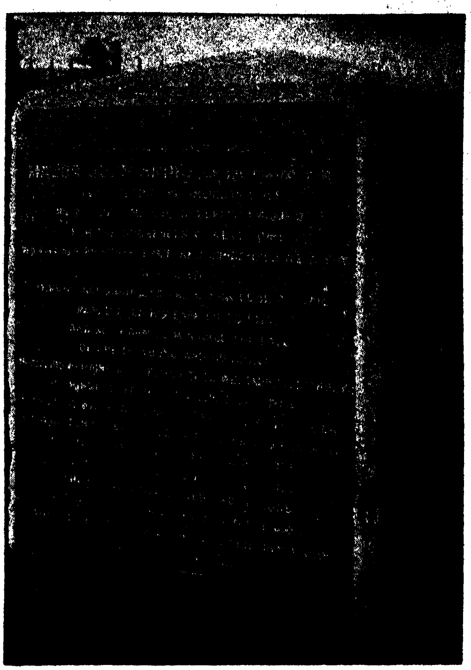
Before he reached West Point, the officer became suspicious and had him brought back, but a soldier went on to inform Arnold of the capture of the man, who, it was thought, had forged his name. Arnold hastily escaped to the Vulture, and reached New York in safety.

When Washington arrived, a military court was assembled, and, after hearing the evidence, condemned the unfortunate young officer to death as a spy, though all regretted to make such a decision. Sir Henry Clinton tried in vain to save his life. On the morning of October 2, 1780, the brave young man was hanged at Tappan, though he begged that he might be shot instead. In 1821 his body was removed to Westminster Abbey and a monument to his memory erected.

THE NEXT STORY OF THE UNITED STATES IS ON PAGE 4057.

TWO SPIES WHOM ALL ADMIRED

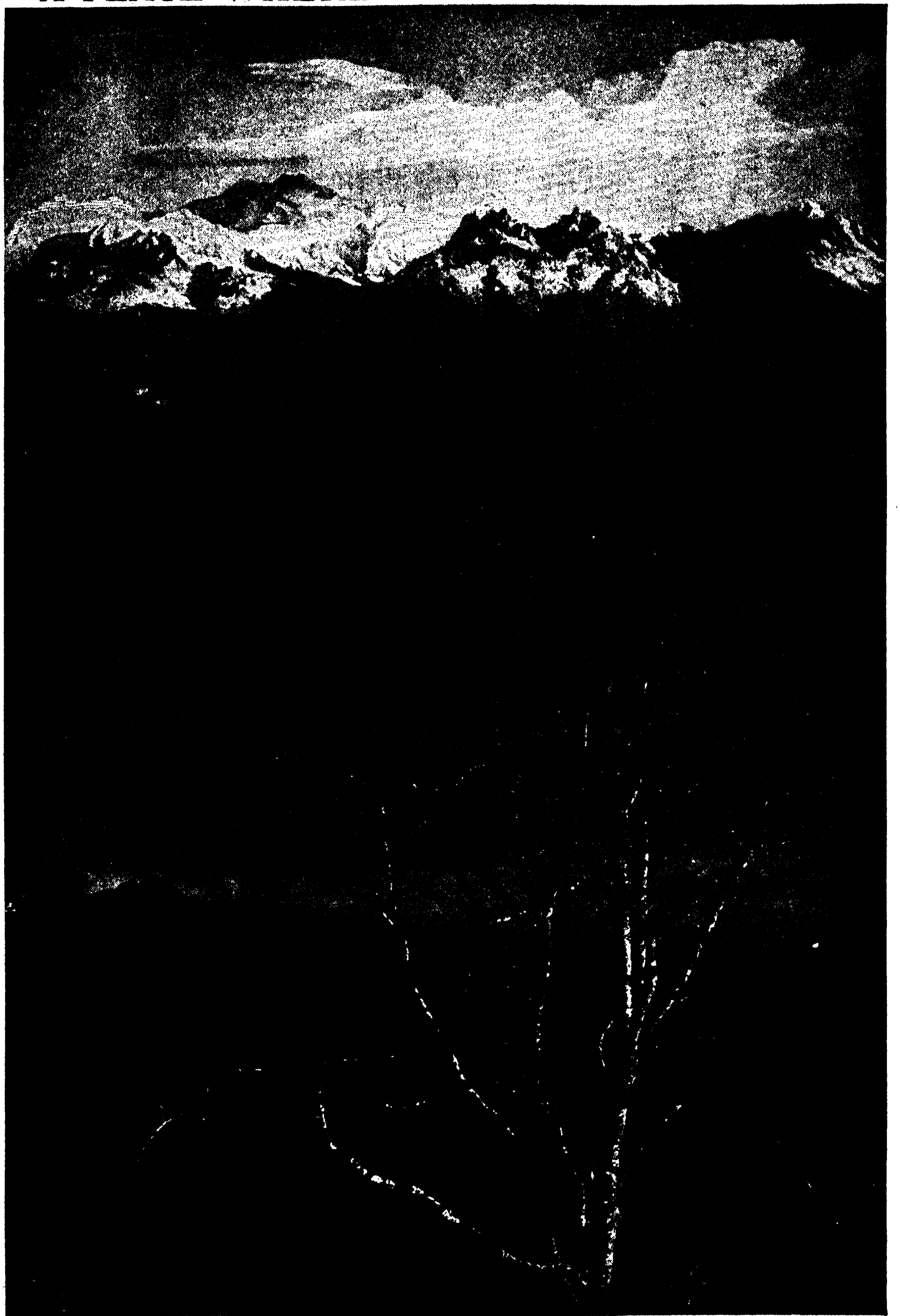
This beautiful statue of Nathan Hale by Frederick MacMonnies stands in City Hall Park in New York City. The brave young officer was hanged as a spy, in New York, September 22, 1776.



This monument in memory of Major John Andre stands on the spot where he died October 2, 1780. It was erected by an American admirer. If your eyes are keen perhaps you can read the inscription.

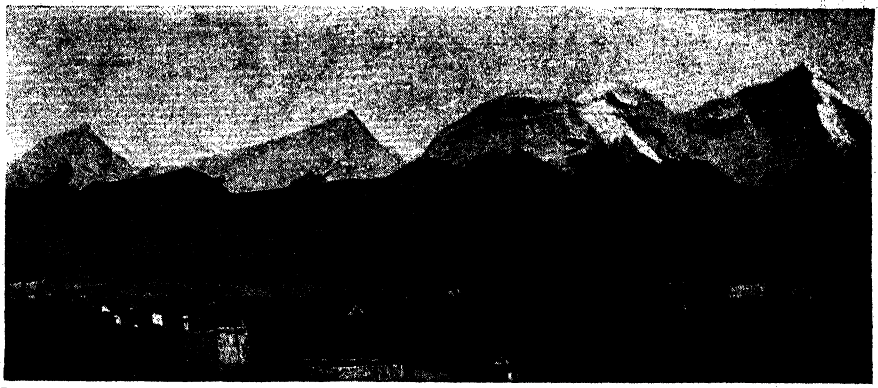
The American officers who condemned Major Andre to death did so with great regret, for his bravery and dignity won the hearts of all, even those of his enemies. Here we see him as his death warrant is being read to him. He begged he might be shot instead of hanged, but his request could not properly be granted.

A PLACE WHERE MAN HAS NEVER BEEN



This is how a mountain over five miles high appears when you stand fifty miles away. It is Mount Kinchinjunga, 28,156 feet high, in the Himalayas, photographed from Darjeeling. The highest peak in the world, Mount Everest, which is 29,002 feet, does not look so high because great mountains surround it. No one has ever been to the top of either peak, for the air is difficult to breathe. In 1900 travelers climbed 21,000 feet up Kinchinjunga, but in South America men have reached the top of Aconcagua, 23,393 feet high.

From a photograph by E. G. Ponting.



In this picture we see the great wall of mountains that encloses the land of Tibet and has acted as a barrier against invasion for centuries. It is the difficulty of getting into the country, across its barriers of mountains and deserts, that makes Tibet still the least-known country in the world.

THE HEART OF ASIA

TIBET, TURKESTAN, MONGOLIA, & AFGHANISTAN

CONTINUED FROM 3864

In the stories of the countries of Europe we often read of the waves of settlers and hordes of conquerors rolling westwards from the heart of Asia. Adventurous explorers have ever been drawn, as with a magnet, to search out the secrets locked up in this great and wonderful heart of Asia, as large as the whole of Europe; but, for the most part, the vast lands, which have sent forth teeming millions to fashion the face of Europe, lie silent in inexpressible grandeur and loneliness.

In Europe more than 400 millions of people live and work, and call for food from near and far; but there is a population of only about 21 millions in that part of Asia lying between Siberia and India on the north and south, and Persia and China on the east and west. By far the greater number of these 21 millions make their homes in tents, and wander about in search of fresh pasture for the immense flocks and herds that they rear on the steppes; others till the soil of the fertile valleys and oases that are made to smile by the life-giving waters of the rivers. The chief point in Central Asia is the "Roof of the World"—the Pamir Plateau—north of the great bend which the Indus makes when it breaks through the Himalaya Mountains. The treeless and rocky valleys of this tableland, covered with snow for many months of the year, equal in height the highest mountains in Switzerland, being about three miles above the level of the sea. The mountains that cross it and surge around it rise a mile or more higher still. To understand the connection of this well-named "Roof of the World" with the immense ranges that meet upon it, we must study a relief map of Asia.

From the south-west corner of the plateau spring the mighty heights of the Himalayas, the abode of snow, extending for 1,500 miles eastwards above the plains of India. The majestic range of Kwen Lun, with the loftiest passes in the world, runs eastward from the south-east corner of the Pamirs. From the north of the plateau the great Thian Shan range—the "Mountains of Heaven"—runs eastward for a distance as far as from London to Petrograd, towards the Mongolian plateau, which in turn is crossed by the Altai Moun-

tains, south of Siberia. From the south-west of the Pamir Plateau the ranges of the Hindu Kush cross Afghanistan. These run on to form the northern boundary of the Persian desert, and join the Elburz Mountains south of the Caspian Sea. Many shorter ranges, such as the Karakorum or Mustagh—whose greatest heights tower not far below the height of the main Himalayas—and the Sulaiman, gather like buttresses round the "Roof of the World."

THE WHITE MOUNTAIN PEAKS THAT LOOK DOWN UPON CENTRAL ASIA

If we could but look down from above on these giant mountain walls—the framework of Central Asia—what a scene of extraordinary beauty and desolation would meet our eyes! Nearest us would be the dazzling white of the snowy peaks, for most of the mountains of Central Asia are far above the line of perpetual snow, surrounded by immense glaciers and ice-fields. In contrast with all this would be the dark, bare pinnacles of rock, the fearsome precipices and cliffs, girdled lower down by dark forests and rushing streams. From these, grassy slopes stretch downwards, covered with lighter vegetation, and relieved in places with masses of crimson rhododendrons and other Alpine flowers.

Between these mountain walls, which act as barriers to the moisture in the air, to plants and animals, and to races of men, lie the countries that make up Central Asia. For the greater part these countries can be filled in, in our broad picture, with a tone of brownish yellow, relieved here and there by splashes and long streaks of green. This vivid green vegetation often connects the dark green foliage of the mountain forests and the grassy slopes with the vast extent of yellow desert below.

THE LITTLE KNOWN LAND WHICH STANDS THREE MILES ABOVE THE SEA-LEVEL

Let us now find these countries upon the map. On the east of the Pamirs is the high tableland of Tibet, between the Himalayas and the Kwen Lun Mountains. Tibet is more than four times as large as Arizona, and most of its surface, like the Pamir Plateau, is three miles above the level of the sea, with many peaks rising higher still. Eastern Turkestan, more than four times as large as Colorado, is bounded by the Hindu Kush, the Pamirs, and the Thian Shan Mountains, and the great desert. Much of the country is desert, and it is only along the Tarim river, and the few rivers that run into it that there is any cultivation of pasture.

The vast upland of Mongolia, of about the same area as Arabia, lies beyond the Thian Shan Mountains, and is bounded by Siberia and Manchuria. All these three countries of Central Asia have long been practically part of the vast Empire, now the Republic, of China.

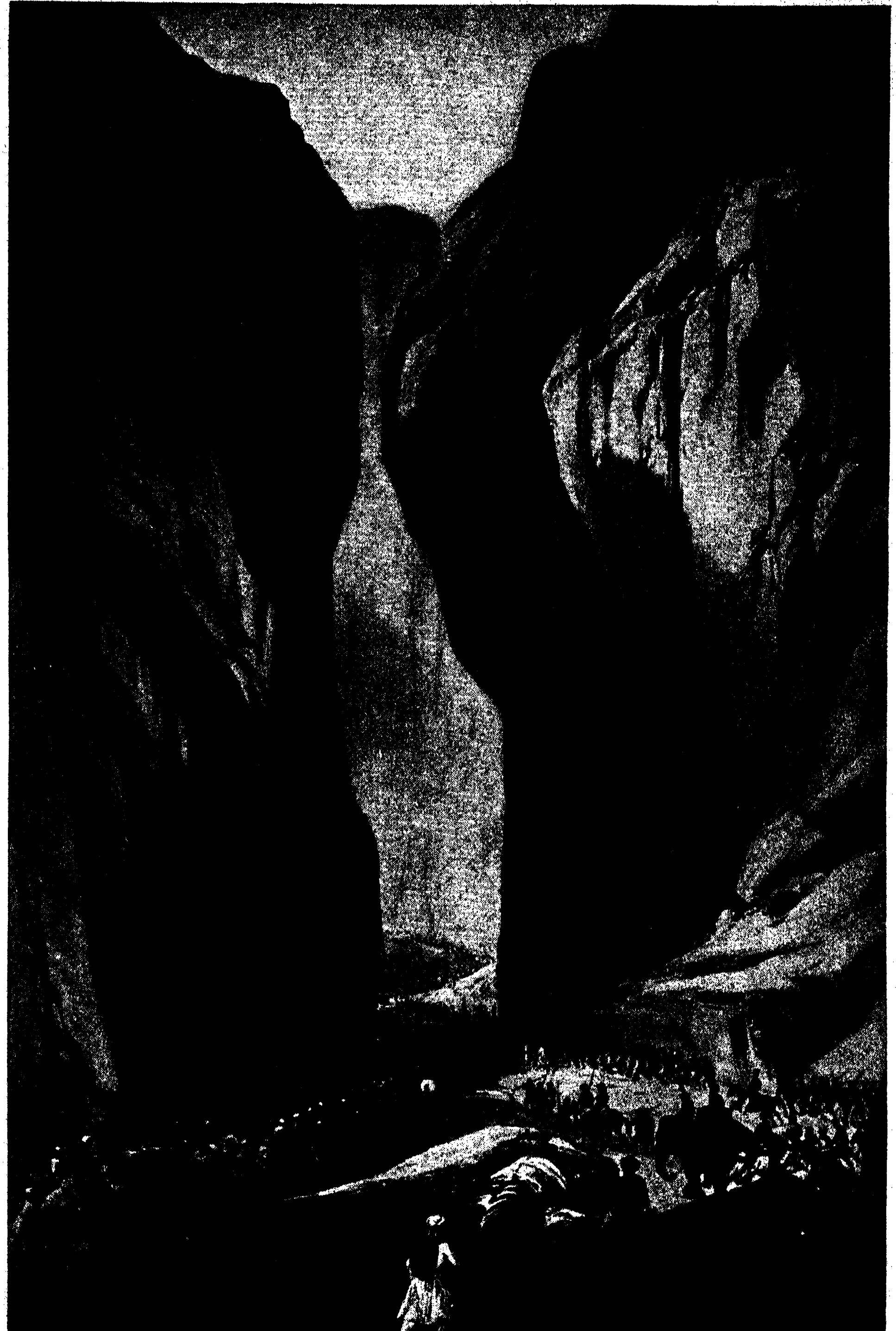
It is Afghanistan and British India that are chiefly concerned in the important passes to the south-west of the central plateau in the Hindu Kush and Suliman ranges. The fourth of the Powers whose dominions meet on the Pamirs is Russia. Two great rivers, the Syr Daria and the Amu Daria—Daria is the Persian word for river—flow from the heights of the Thian Shan and the Pamirs over the plain of Western Turkestan to the inland sea of Aral. Russian Central Asia stretches over these valleys from the Pamirs to Siberia, from the Caspian to the borders of Eastern Turkestan, nearly one-half the area of the United States.

WANDERING TRIBES & FERTILE VALLEYS IN THE GREAT DESERTS OF ASIA

We read in the story of Russia that begins on page 3797 how much of this vast country is desert, and how much consists of grassy steppes on which wandering tribes, such as the Kirghiz and Turcomans, raise immense flocks and herds. We may at the same time glance at the fertile oases and river valleys, with their fine crops of fruit, vegetables, grain, and cotton for the mills of Moscow and Warsaw. In parts of West Turkestan coal is found to be abundant, and it will be of great use as fuel for the railways and river and lake steamers of the district if ever the supply of petroleum refuse from Baku, which is now used, should fail.

Russian enterprise has brought the railway from the Caspian to the foot of the Thian Shan Mountains, linking together the towns situated on the oases and in the fertile valleys. One likes to think what the impetuous Tamerlane, who made his headquarters at Samarkand, would have thought of this rapid means of transit. A branch line is being made from Merv, the last

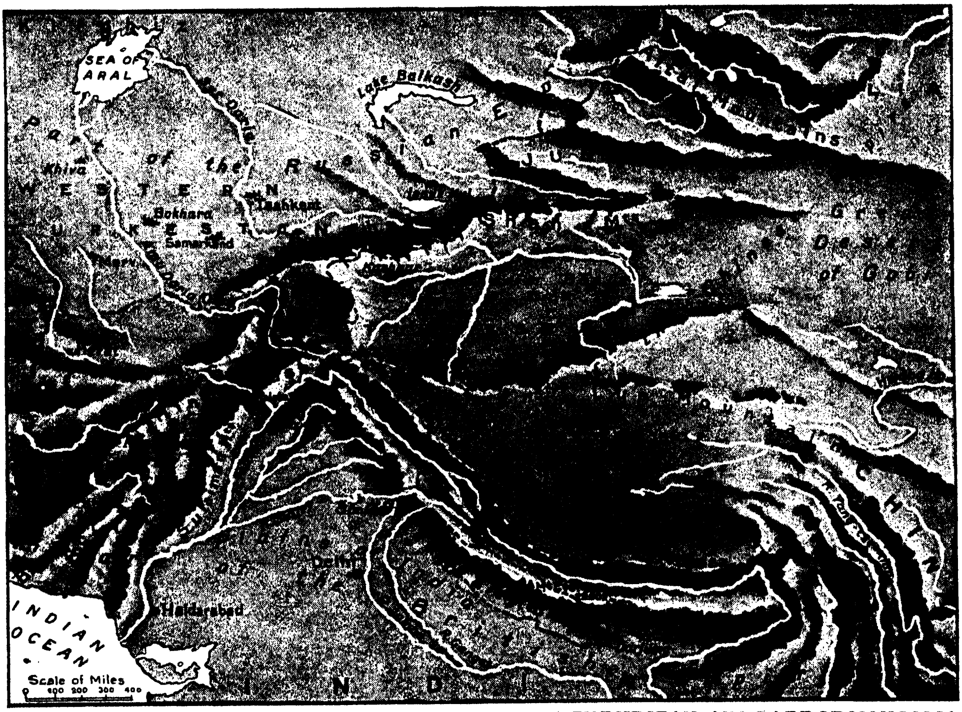
A MOUNTAIN PASS THAT LEADS TO INDIA



India is cut off from the rest of Asia by ranges of high mountains. There are only one or two passes through which she can communicate with the surrounding nations. This is a picture of the Bolan Pass, through which lies the route to Afghanistan. It shows the British troops marching through to Kandahar.

stronghold of the warlike Turcoman tribes, subdued by Russia in the middle of the last century, towards the Afghan frontier near Herat, to meet, in course of time, the British railway that is being made from India through the Bolan Pass, of which there is a picture on the preceding page.

Thus, far into the heart of Asia, the shriek and snort of the "iron horse" wakes the solitude and opens up possibilities of trade and travel on very different lines from those of old, which are covered by forests. The great Desert of Gobi, treeless and waterless, about 2,000 miles long, lies in its midst; and in the north-west the off-shoots of the Altai Mountains give rise to many rivers that make fertile valleys. The greater number of the people of Mongolia are shepherds, tending their great flocks and herds as their ancestors have done from time immemorial, and living much the same life that they have done through the centuries. But the Mongols have ever been irresistible warriors, too,



MAP OF CENTRAL ASIA, SHOWING AFGHANISTAN, TIBET, TURKESTAN, AND PART OF MONGOLIA

we can still study in Chinese Central Asia. The caravans of camels and ponies and asses, laden with goods, passing from one boundary to another, still toil over ancient routes from oasis to oasis, across deserts, by difficult mountain passes; and the intrepid explorers, to whom we owe most of our knowledge of this part of the world, make up their own caravans, taking their own provisions, boats, tents, maps—in fact, everything they need—along with them. It is very easy to perish of hunger and thirst in these parts of Central Asia.

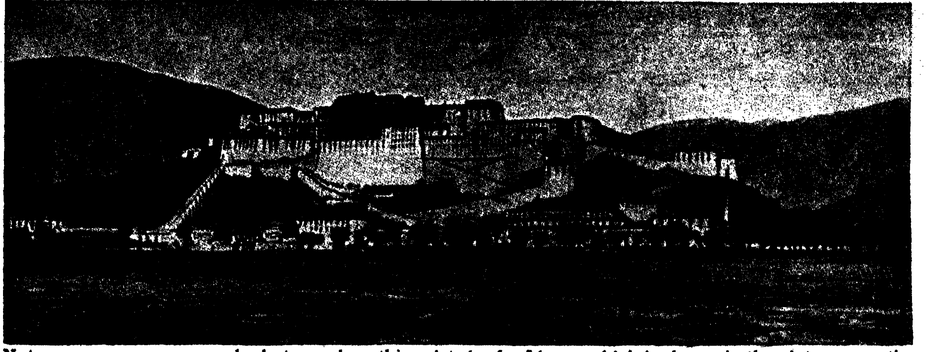
Let us start our travels in Mongolia, the vast grassy uplands lying between China and Siberia, and girdled by snow-topped mountains, whose lower slopes

as well as shepherds, when occasion and great leaders arose.

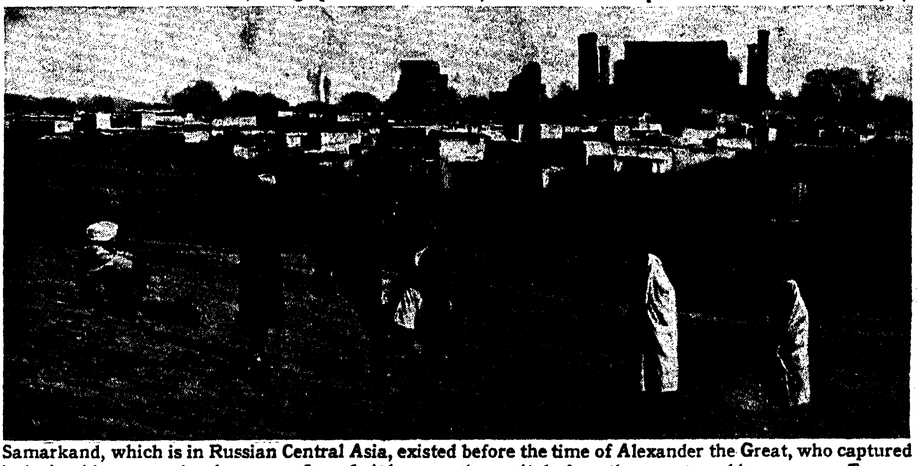
It was a branch of these people, called the Huns, who swept across from the south of Lake Baikal, round which the Siberian railway now circles, along the "Land of Grass," which stretches from the banks of the Amur to those of the Volga. We know how they terrorized the dwellers in Europe, till their great leader, Attila, was turned back at Châlons, not far from the Atlantic, in the middle of the fifth century.

Another branch of the Mongols, the Turks, who were settled near the rich metal-bearing Altai range, became for a time very powerful in Central Asia; and they, too, moved westward along

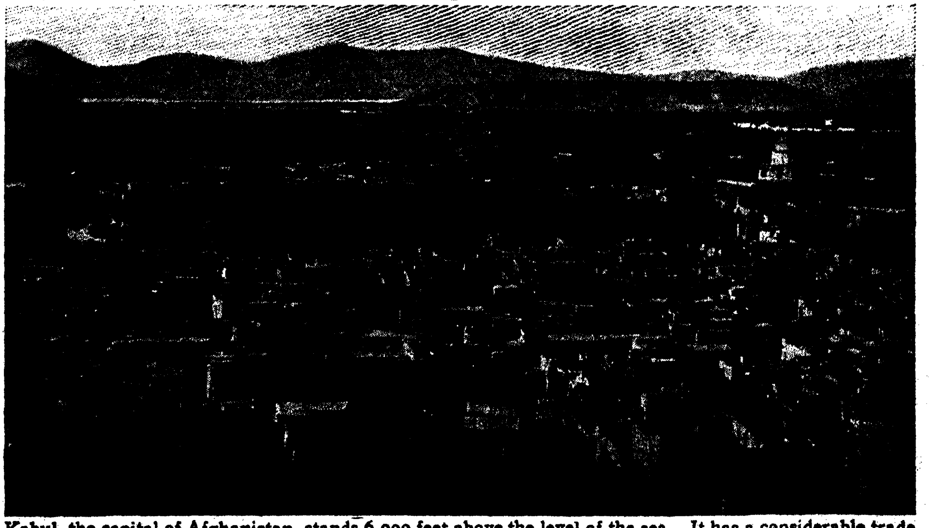
FAMOUS CITIES IN THE HEART OF ASIA



Not many years ago no such photograph as this existed ; for Lhasa, which is shown in the picture, was the mysterious city of Tibet that no European was allowed to approach. Its name means the Home of the Gods, and it is here the Dalai Lama, or high priest of Buddhism, lives. A British expedition entered Lhasa in 1904.



Samarkand, which is in Russian Central Asia, existed before the time of Alexander the Great, who captured it during his conquering journeys. In 1369 it became the capital of another great world-conqueror, Tamerlane, or Timur, who from it ruled his empire. The green stone used by him as a throne is still in the city.



Kabul, the capital of Afghanistan, stands 6,000 feet above the level of the sea. It has a considerable trade in carpets, shawls and silk goods, and the district round is noted for its fruit. It was from Kabul that Lord Roberts set out in 1880 on his historic march to Kandahar, where he defeated the Afghans.

the "Land of Grass," a few centuries after Attila. We know how strongly they influenced the history of Western Asia and of Europe. We also know how soon the Turks adopted Mohammedanism when they came in contact with it. This religion, simple and direct when it was first taught, has ever appealed strongly to the wandering tribes of Central Asia, most of whom, to this day, observe its customs, and devoutly say their prayers facing towards Mecca.

All through the early centuries advances were constantly made on Central Asia by the neighboring and ancient Empire of China, partly owing to the rise of trade, and partly through wars, in which sometimes the Mongols had the best of it and sometimes the Chinese.

When Jenghiz Khan, the "Perfect Warrior," arose early in the thirteenth century to lead the Mongols, he conquered not only the rest of Central Asia, but Persia and China too, though it was not till a century later that Mongol emperors were firmly established in China, where they ruled for a period of 200 years. After this the Mongols were driven out of China, and Mongolia then became a Chinese province.

THE CONQUERING HORDES OF TARTAR WARRIORS THAT SWEPT ACROSS ASIA

In the story of Russia we may read of the arrival of the Mongolian Tartars, on the north of the Black Sea, also of the arrival of succeeding hordes as the years went on, and of how strongly their influence stamped itself on the country for 300 years. This influence is felt to this day. We know, too, how Timur, or Tamerlane, burst with his destroying armies over Persia and India, and then far away to Asia Minor, where he arrested for a time the power of the Ottoman Turks. The story of the great Mogul power in India, in the days of the Tudors and Stuarts, is told on page 1716.

At the same time that these fierce Mongols were setting fire to all the world within their reach, and in many cases retracing their steps after two or three hundred years towards their original home, the old life on the steppes and the deserts was still going on. The patient camels were plodding along the old trade routes, with but temporary hindrance, carrying the silk from China, the precious jade stone from South Turkestan, the beautiful carpets, and soft hangings, and all the other treasures and riches of the East which made it seem a perfect wonderland to Western minds.

But the Westerns, as we shall see later, for many hundreds of years had no chance of traveling and exploring in the wide regions of Central Asia, as these regions fell more completely under the power of the Chinese Empire.

A MIGHTY RIVER THAT HAS NO MOUTH AND NEVER REACHES THE SEA

The two important towns of Kashgar and Yarkand, on the trade routes from China to India and Russia, lie at the western end of Eastern or Chinese Turkestan, where the streams come down from the heights of the Pamirs and make some cultivation possible in this wide and desert country.

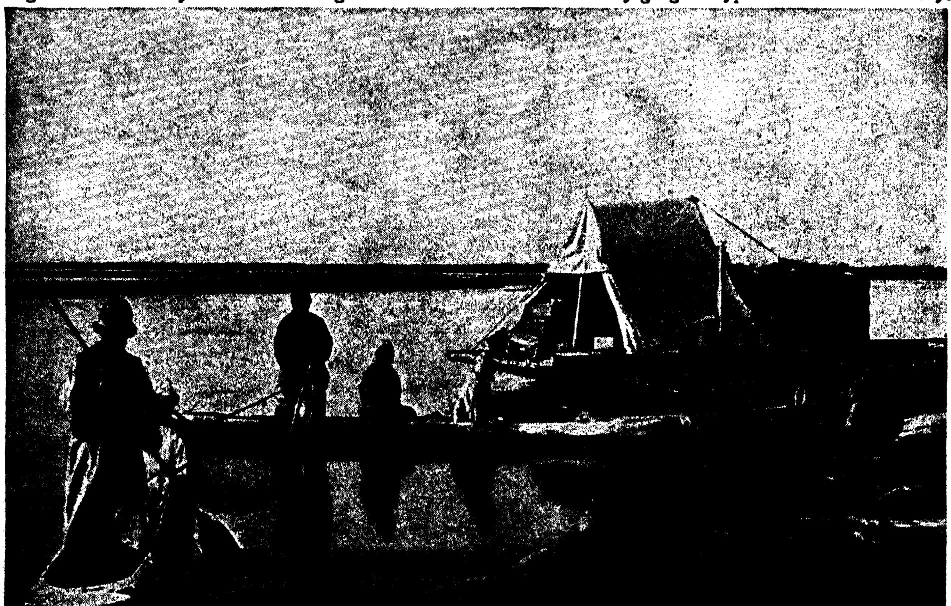
The great Swedish explorer, Sven Hedin, spent much time in Chinese Turkestan, and to him we owe nearly all that is certainly known of the great River Tarim and its tributaries. Making his way over the outlying mountains of the Pamirs from the railway terminus of the Trans-Caspian line, he arrived at Kashgar while a great fair was going on. He soon pushed on to a town on the upper part of the river, and, after collecting native boatmen and stores and adapting a sort of house-boat, he started on his wonderful journey on the Tarim, a river as long as the Danube. Unlike the Danube and other rivers, the Tarim has no mouth and never reaches the sea, but dwindles away, after a long and winding course across a vast expanse of thirsty sand, in a system of shallow lakes.

A FAMOUS EXPLORER'S LONG JOURNEY ON AN ALMOST UNKNOWN RIVER

Sven Hedin spent three months in his house-boat, drifting, paddling, and sailing, making observations and mapping out the winding course, as he noted the surrounding country. On the banks of the river and its tributaries was every variety of scenery. Women and children waded out to bring melons and other food for his use from villages amid cultivated fields; groves of trees delighted his eyes, some like enchanted forests with the gorgeous red and gold of the autumn leaves, the stillness being sometimes

MOUNTAIN AND PLAIN IN CENTRAL ASIA

The land of Tibet is about a fourth the size of the United States, is enclosed by the loftiest mountains in the world, and is higher up than any other country of its size. It consists of great plateaus, and the average height of the country is said to be as great as Mont Blanc. This dizzy gorge is typical of Tibetan scenery.



Away from the mountains, the heart of Asia consists of vast deserts, cut up by rivers, and dotted with lakes that seem to be disappearing as the deserts extend. This picture shows the boats used by the people.

Reproduced, by permission, from Dr. Sven Hedin's "Scientific Results of a Journey in Central Asia."

broken by the flight of the wild ducks and geese on their way to winter quarters. Then came long stretches of pasture land, where lonely shepherds watched their flocks and fled terrified at the sight of the strange-looking tent-boat. It was the explorer's turn to be terrified when the green eyes of the tigers that came down to the river to drink, lapping like our tame cats, gleamed out of the darkness, and the tall reeds rustled and whistled in the breeze.

A RIVER THAT RUNS IN A DESERT BETWEEN HIGH CLIFFS OF SAND

All this time the sand that lay for an immeasurable distance on both sides, beyond the streak of cultivation brought by the river, was out of sight. Presently, however, it pressed forward and formed high banks like cliffs, between which the boat glided on her journey in dreary stillness.

The ice stopped the boat at last, for when the river froze, the explorer had to start on the equally exciting and more dangerous part of his journey by land. Then came the loading of camels with food, firewood and other necessaries, and choosing of horses and asses and dogs, with the help of the natives who acted as guides and companions. Day after day they wound their way for nearly 200 miles across the desert. Sand-storms, difficult climbing over the loose sand-hills, piercing cold that froze the ink in the explorer's pen, scarcity of provisions—all fell to their lot.

But many interesting facts were discovered or verified, such as the shifting of lake and river beds, the former existence of forests where nothing now grows, and, most wonderful of all, the explorer discovered that cities whose remains now lie buried under the penetrating, ever drifting and shifting masses of sand that cover everything, once flourished in this dry, silent waste.

THE JOURNEY OF A LITTLE ENGLISH BOAT OVER THE DESERT LAKES OF ASIA

We long to linger with Sven Hedin in his adventures among the wonderful lakes in the Lop Nor district where the Tarim is finally lost. He reached this district when the spring had brought scorching heat and mosquitoes—very hard to bear in the desert solitudes. With a little canvas boat from England he paddled over the wide lakes, some gleaming with fish and wild swans, some intensely salt and still, and bearing no sign of life whatever. But we must hurry on to cross the high passes of the north mountain wall of Tibet, some 2,000 feet higher than the tops of the highest mountains of Switzerland. Here we feel intense cold, as well as tremendously high winds, blinding snow-storms, and terribly rough paths. But the grand precipices and giant peaks are a fitting match for the southern rampart of Tibet—the glorious Himalayas.

The great Indian rivers, the Indus and the Brahmaputra, rise close together in the southern valleys of Tibet, and then flowing on, one west and the other east, break through the Himalayas in grand gorges more than a thousand miles apart on their southward search for the sea. The most fertile part of Tibet is in the upper part of these rivers, and of other rivers that flow eastwards to China. On the wide-swept, high plateau, dotted with lakes, the people rear large herds of sheep and mountain goats, and yaks carry burdens over the difficult and dangerous mountain passes.

A LAND THAT IS GUARDED BY GLITTERING RAMPARTS IN THE CLOUDS

Tibet is one of the most extraordinary countries in the world, and its history and present state is chiefly owing to its position, that of a citadel strongly guarded by glittering, icy ramparts in the clouds.

For a long time Tibet was little affected by the wars and migrations and changes that went on in the rest of Central Asia. From hunters its early people developed into herdsmen, with yaks to carry their loads as they wandered about. Later they began to cultivate the soil where rivers made it possible, and as they became more civilized their power grew so much that they became formidable enemies even to China.

In the meantime a wonderful invasion was taking place in Tibet, and, indeed, it is the only one that has really mattered in the country's story. That ancient and wonderful religion of India, Buddhism, spread by slow degrees over Tibet, and in the course of time, as its influence lessened in India, it increased in Tibet, till at last that isolated and mysterious country, of which the outer world has always known so little,

THE PEOPLE WHO LIVE IN CENTRAL ASIA

The present inhabitants of Mongolia are wanderers, like their ancestors. Here we see a wealthy Mongol gentleman.

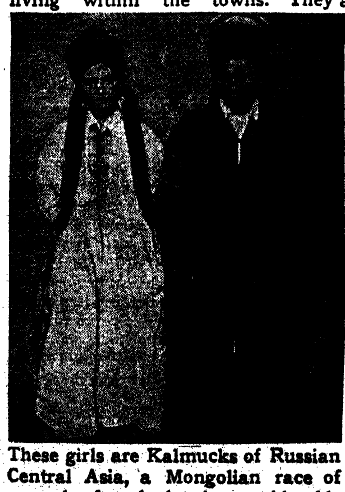
These are Sarts of Russian Central Asia. The word Sarts is used for the settled people, agriculturists and traders, as distinct from the nomads.

A rich Turcoman of Bokhara, where wealth consists chiefly of sheep, goats, and camels. The Turcomans were once brigands.

The Afghans are a fierce warrior race who dislike living within the towns.

The Beloochis are a tall, daring race, although lazy, and much given to brigandage. They almost always go about well armed.

This is a native soldier of Tibet, armed with a curious flint-lock gun common in the country.



These girls are Kalmucks of Russian Central Asia, a Mongolian race of nomads, found also in considerable numbers in the Chinese Empire.

Here we see a Dervish of Samarkand, the once famous capital of the great Tamerlane, who is buried there.

Women belonging to the Tartar tribes living in Russian Central Asia. This race came from Chinese Tartary, and were formerly great conquerors.

became its chief headquarters. Naturally, Tibet shared to some extent in the convulsions that shook the old empire to which it was eventually attached; but, outside, worldly matters seemed to pass unheeded by the Tibetans as they became more and more absorbed in their religion and its observances.

HOW THE BRITISH ENTERED LHASA, THE MYSTERIOUS CAPITAL OF TIBET

Many travelers have of late years been turned back from its borders, for the Tibetans share the Chinese dislike of foreigners. However, a British force, sent to settle some trade arrangements, succeeded in entering Lhasa, the capital. Under a new agreement, a British agent now lives in the country, and may, if he thinks it necessary, visit Lhasa with his escort. Tibet is ruled by the Dalai Lama, through a regent, who is assisted by five ministers. Tibet belongs to China in name, but China has really no power over it.

Thousands of Buddhist pilgrims from China and India wend their way to worship at the holy city of Lhasa, and to reverence the Dalai Lama. He lives a short way from Lhasa, in a mysterious, huge white palace on the crest of a hill, the centre part a blaze of crimson, the roofs of glittering gold. Who can tell of the treasures inside, brought by the devout pilgrims from the rich East?

It is said that in Tibet there are 20,000 priests, or monks; in one monastery alone, near Lhasa, there are 6,000. Every family dedicates at least one son to the priesthood. This being the case, it is scarcely to be wondered at that the spirit of devotion to the religion of Buddha has very deeply influenced the Tibetan people, who have so little intercourse with the outside world, that holds such different opinions from their own.

A LAND OF MANY PRAYERS WHERE MEN WORSHIP BY MACHINERY

Religious inscriptions are seen on the rocks, houses, and temples; prayer-wheels, such as those to be seen in the Room of Religions in the British Museum, turned not only by hand, but by wind and water, reel off prayers to the Deity amid the flutter of praying-flags. When the day is ending, and the dark rocks stand out grim against the sky, all work stops, the people gather in the squares and open places, and, prostrating themselves on the earth, chant the evening prayers. Very different has been the story of Afghanistan, on the other side of the Pamirs. Through the Khaibar Pass, thirty-three miles long, and in parts only ten to seventy feet wide, many conquerors have marched to the rich plains of India, and there have been numerous fights and struggles about other passes and the chief towns—all keys to India—as well as stations on the old caravan routes to French Indo-China and Persia.

Afghanistan has had its share in all the devastations and conquests of the centuries, for Arabs and Turks and Mongols have swept across it in turn. For a time, as we know, its Mongol rulers were supreme both in Persia and India; then their power ebbed again, and the hardy Afghan mountaineers became independent once more in the middle of the eighteenth century.

The British have bitter memories connected with many of the towns and passes. In 1842, a British army of 4,500 men, with 12,000 followers, left Kabul to retreat to India through the snowy passes which it commands. One man alone survived the constant attacks of the Afghans and the hardships of the way, and stumbled into Jellalabad on his exhausted pony, fainting, and hardly able to tell of the disaster and the fate of his companions. Of this large army 690 were Europeans; the rest were Asiatics.

THE FAMOUS MARCH OF LORD ROBERTS FROM KABUL TO KANDAHAR

In August, 1880, Lord Roberts made his famous march in twenty-two days from Kabul to Kandahar to restore order after the risings and losses following the settlement of the frontier boundaries.

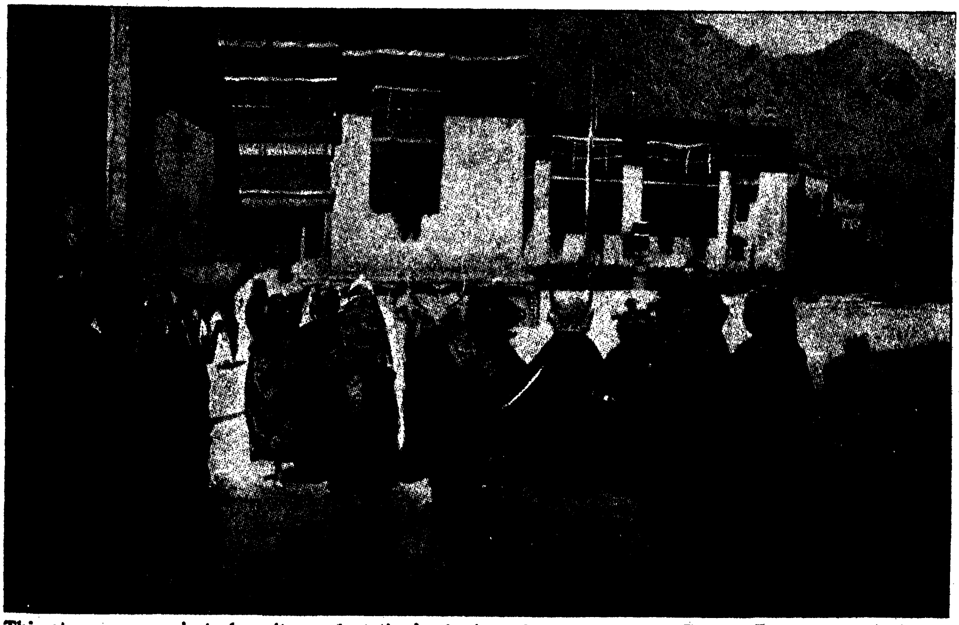
If we turn to page 60, we can read the story of Marco Polo, the Venetian boy of fifteen, who walked to China in the thirteenth century. He was twenty-one when he reached the end of his journey. It will interest us to trace his route, for we, too, have crossed Syria to Mesopotamia and Baghdad, and found our way to the Persian Gulf. We have wandered, too, round the mountains and deserts of Central Asia. After a stay at Ormuz, finding it impossible to go on by sea, the boy, with his father and uncle, went north through Persia and Afghanistan.

Here the party had to rest awhile on account of Marco's illness; he greatly

enjoyed the fine mountain air and scent of the pine-groves as he was getting better. Then, by the upper courses of the Amu Daria, formerly called the Oxus, the party pushed up to the Pamir Plateau itself, and then descended on Kashgar, Yarkand, and Khotan. The Tarim basin was next crossed to Lop Nor. Finally, by the route to the north of China, the city of Peking was reached at last. These regions were closed to foreigners soon after this wonderful journey, and they were not described again by Europeans until six hundred years had elapsed.

We have found much to think over while looking at the map of the heart of Asia, and while following the footsteps of the brave travelers who have faced its mysteries and dangers. We have realized, too, whence came the streams of conquerors into Europe—the conquerors whose names and deeds and personal appearance are familiar to us. And yet we have still many questions to ask.

What of that dim host that, in the distant past, spread over India and Europe and left traces of their ways of life, and of their thoughts, in words that have been handed down through countless generations? Where was their first home, and why did they leave it? No one yet knows, though explorers and lovers of the study of Mother Earth's secrets, and of the languages spoken by her children, are all trying to find out. They say that perhaps a great open sea once glittered in the sunshine, where the vast plains of Siberia now lie in swamps, with great salt inland lakes, such as the Caspian and Aral, that were left behind when the rising land pushed the ocean ever farther north. The wooly mammoths imprisoned in the ice tell of such mighty and overwhelming changes. So, perhaps, what is now the dry and sandy heart of Asia was once a forest-covered seaside land, tempered by refreshing breezes that brought rain and moisture to a country that was not nearly so high as the "Roof of the World" is now. For when the bed of the northern ocean rose, the mountains and plateaus may have been pushed up, too, so that river basins and courses were completely altered, and the climate, instead of being pleasant and temperate, became one of great extremes in heat and cold.



This strange scene is to be witnessed at the beginning of spring all over Tibet. The country is full of monasteries, and at the religious festival of spring the lamas, or monks, wear strange and hideous masks, in striking contrast to their gorgeous silk robes. The monastery in this picture is the famous one at Himis.

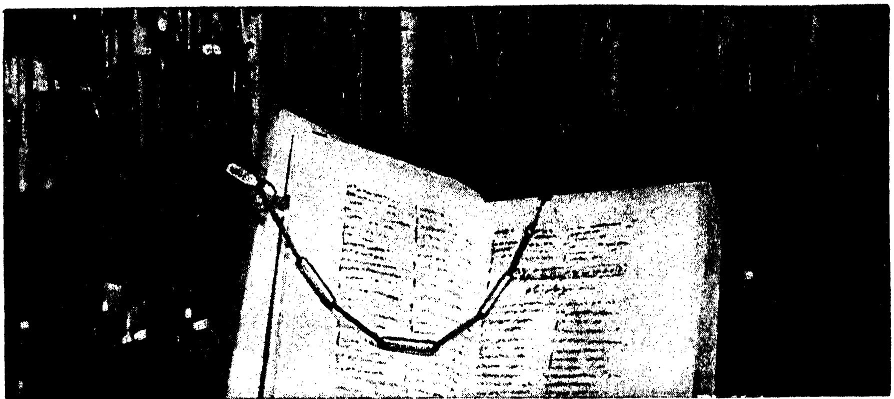
Perhaps it was changes such as these that may have driven the early peoples of what is now Central Asia to the plains of India, and ever farther across Eurasia towards the lands of the setting sun.

THE NEXT STORY OF COUNTRIES IS ON PAGE 4077.

THE FATHER OF ENGLISH POETRY

GEOFFREY CHAUCER READING POEMS FROM HIS CANTERBURY TALES AT THE COURT OF EDWARD III.

Chaucer, the first great English poet, lived in the 14th century, before the days of printing. The poet was a favorite at the court of King Edward III., and at times would read his poems before the king and his courtiers, in the way which Ford Madox Brown, the celebrated painter, has illustrated so happily in this picture.



How books were chained long ago, as still seen in an old library at Hereford Cathedral.

MEN WHO FIRST WROTE ENGLISH

HOW THE FIRST ENGLISH BOOKS FIXED THE LANGUAGE

CONTINUED FROM 3772

WHEN we speak of Chaucer as the "father of English literature," we do not of course mean that he was the first writer known in England. We simply mean that, although many men wrote English before his time, he was the first great author who wrote in English that we can read with ease and pleasure.

In the BOOK OF STORIES we read the fine story of Beowulf. This is the first English poem that we have. It was sung in the banquet halls of England long before the great king Alfred reigned. We have a manuscript copy of this poem, which was made perhaps about King Alfred's time, but it was written in what is known as Anglo-Saxon or Old English.

Bede, whose story we read elsewhere, translated the Gospel of St. John into English. He also wrote a charming history of the English nation to his own time, about two hundred years before King Alfred lived. The history was written in Latin, but it is as easy for us to read the book in that language, as it is to read the translation which King Alfred made into the English language, as it was spoken in his southern English kingdom of Wessex.

Alfred, who was not only a great king, but a good writer and a great educator, spent his leisure moments in writing and translating books, so that his people might have books to read in their own language. It was this great man who gave instructions for the record of events called the Anglo-Saxon Chronicle, which was written in the monasteries. Records were made in it until after the Norman Conquest, and though the entries are short, it has helped us to learn the history of the time.

After Alfred and the writers of his time had died, there is a blank in English literature. The attention of the men of the next century and a half was occupied with the struggle with the Danes. Then came the Norman Conquest, and for a long time the English language was looked upon with disdain, as the tongue of a conquered people.

But we are mistaken if we think that *no* literature was produced in English, through books or by word of mouth, during those fierce and turbulent times. In the monasteries patient monks, proud of their skill as penmen and painters, were busy with the chronicles of their day. Tale-tellers

or harpers wandered about the country from hall to hall, from fair to fair, and from inn to inn, singing or reciting ballads new and old for the amusement of their hosts or companions. Plays, clumsily made from Scriptural incidents or romantic adventures, were acted by the peasantry, or by guilds of workmen in the towns, and thus old-time legends were preserved and extended, together with the doings of kings, religious instruction, and songs, lively or sad. In this way, though no great writer lived in these centuries, simple forms of literature were circulated.

The popular tales of the time passed from country to country, and were recast, added to, and ornamented as they traveled. English and Welsh stories were written down in France and then brought back into England, or were turned into Latin by monks. Four or five sets of these stories can be distinguished—the Greek accounts of the siege of Troy, the adventures of Alexander the Great, the heroic deeds of King Arthur, the history of Charlemagne, and later the greenwood adventures of Robin Hood. France was the great workshop for tale-making, and French the language of romance. French was made the language of the palace, the castle and the law court. French, not English, was taught in the monasteries, which were the schools of the time. Gradually the native language suffered change. Grammatical forms were altered. The use of many French words crept in, and the English of the fourteenth century had become so different from the old Saxon English that King Alfred could not have read it.

GEOFFREY CHAUCER, WHO FIXED THE LANGUAGE THAT WE SPEAK

But all the while, English remained the speech of the great bulk of the people. The descendants of the Norman barons, who prided themselves on being English, began to look upon the English language as their own.

Slowly one of the dialects of English—the East Midland, which was spoken in London—gained the mastery, and began to be regarded as standard English. The English kings ceased to feel as Frenchmen. English was spoken more and more by all classes. It was again made the language of the courts of law. Poets began to write in it. The time had come for some one to establish for ever the language, by using it in books that all men would read. The man who did this work was Geoffrey Chaucer.

Chaucer was born in London, by the side of the Thames, but *when* is one of the puzzles of history. For centuries the date was believed to be 1328, but more facts keep coming to light, and now we know it could not have been 1328, but probably was 1340, or thereabouts. We know this because in 1357 Chaucer was page to the wife of Prince Lionel, son of Edward III, and she spent about twenty-five dollars of our money to buy him a suit of clothes, including a pair of red and black breeches.

THE BOY WHO GREW UP TO BE REMEMBERED FOR EVER

Chaucer was just the man to write poems picturing all the different kinds of people living in his day, for he saw much of the world. His father, a wine merchant, was connected by business with the king's court. As a boy the poet had a sound education, to which his experience as a page added manners and a gentle bearing. While he was yet in his teens he went to France with the army of Edward III, and was taken prisoner, but ransomed. The king himself paid a part of the cost.

Six years later Chaucer was one of the "valets of the king's chamber," and afterwards, when between thirty and forty, he crossed to the Continent seven times on the king's service, and once remained in Italy nearly a year. At the height of his prosperity the poet sat in Parliament, but his fortunes declined with those of his faithful friend John of Gaunt.

Chaucer was not only a man of learning, but a man of the world, trusted by the greatest of his day, and a traveler of wide experience. His writings show the influence of his travels. At first he translated and imitated the French poets. Then he was captivated by Dante, the greatest poet of the Middle Ages, and by Petrarch, whom he probably met in Italy. But though his later poems often borrowed both their form and their subjects from Italian works, they became increasingly English in thought and original in treatment.

CHAUCER'S PICTURES OF HIMSELF IN HIS POEMS

Before asking what kind of man this Chaucer was in appearance, let us learn how to read his verse—an easy matter if we notice two or three points.

Some of his words have passed out of use, or have changed their meaning, and we may have to look for their old meanings in a glossary. Many words were spelled out more fully than now, and had an extra syllable—as *newë* for new, *bookës* for books, and *gamë* for game. Then words borrowed from the French kept the emphasis on the last syllable, as rea*son* for reason, and vir*tue* for virtue. Also *tion* endings are not pronounced as *shon*, but in the French way, as if they had two syllables and were spoken *ce-on*. On this page you will find some extracts from his poems, which show that by taking a little trouble, we can read them for ourselves.

In his writings Chaucer has outlined a picture of himself, and we can fill it in from other personal jottings. Stout in body, pleasantly roguish in face, quiet and retiring, though a man of the world, his bright eyes see everything.

Though a student deeply in love with books, he is no hermit, but takes cheerfully whatever life comes to him among his fellow-men, and thanks God for it. He cannot resist the chance of poking quiet fun even at men whom he admires. His best mood comes in response to the call of spring. Then he goes out of doors, and is charmed by the flowers, and the small birds. Most of all, he loves the modest daisy. Nothing but death, he says, can take the love of this flower from his heart.

This is how this gentle writer is invited to step forward and show himself among the pilgrims of his "Canterbury Tales."

"Thou lokest as thou woldest finde an hare,
For ever up-on ground I see thee stare.
Approche neer, and loke up merily.
Now war yow, sirs, and lat this man have place;
He in the waast is shape as wel as I;
This were a popet in an arm t'enbrace
For any woman, smal and fair of face.
He seemeth elvish by his contenaunce."

The Pilgrims on Their Way to Canterbury—the Last Rider is Chaucer.

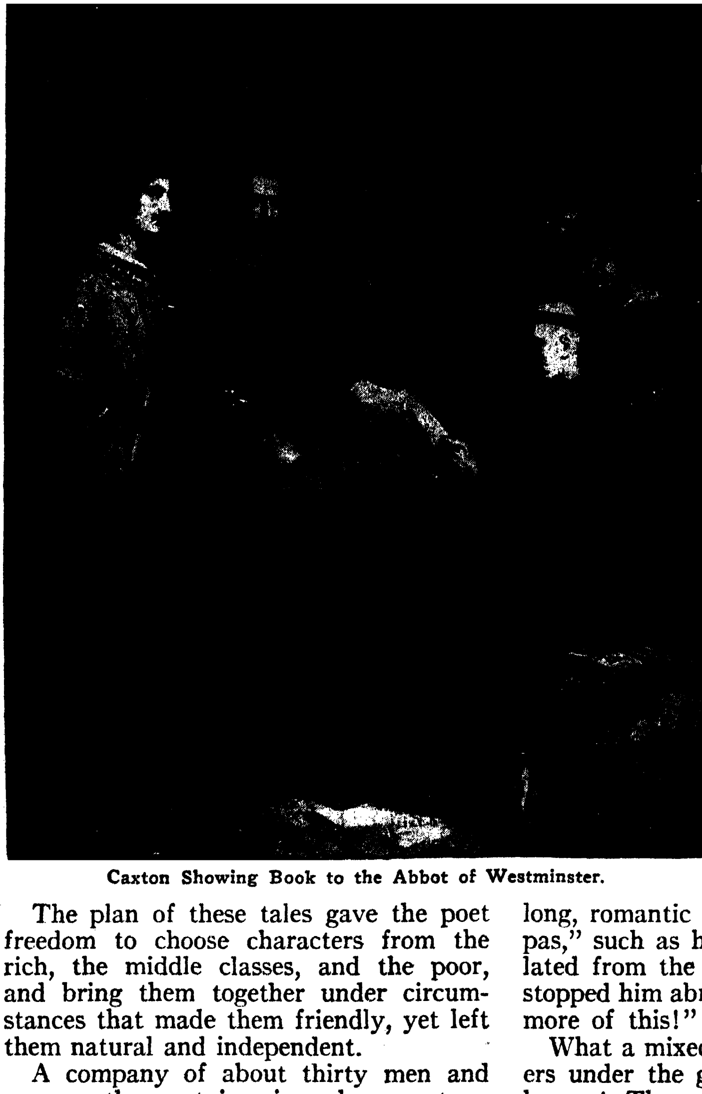
In another poem he is described as buried in his books when his day's business is over.

"But of thy verray neyghebores,
That dwellen almost at thy dores,
Thou herest neither that ne this;
For whan thy labour doon al is,
And hast y-maad thy rekeninges,
In stede of reste and newe thinges,
Thou gost hoom to thy hous anoon;
And, also domb as any stoon,
Thou sittest at another boke,
Til fully daswed is thy loke,
And livest thus as an hermyte,
Although thyn abstinence is lyte."

Below Chaucer again views himself among his books. Remember that *lyte* means little, *foules* means birds, and *war yow* means make way.

"So hertely, that ther is game noon
That fro my bokes maketh me to goon,
But hit be seldom, on the holyday;
Save, certeynly, whan that the month of May
Is comen, and that I here the foules singe,
And that the floures ginnen for to springe,
Farwel my book and my devocioun!"

The poet's writings fill seven hundred pages of close print, but the poems that picture him for us at his best are a collection called "The Canterbury Tales," which he had not finished when he died.



Caxton Showing Book to the Abbot of Westminster.

The plan of these tales gave the poet freedom to choose characters from the rich, the middle classes, and the poor, and bring them together under circumstances that made them friendly, yet left them natural and independent.

A company of about thirty men and women, the poet imagines, have met on an April day at the Tabard Inn, in Southwark, over the Thames from London, to start on a pilgrimage to the tomb of Thomas à Becket at Canterbury. They made a merry group, bent on enjoyment as well as religious duty; and the landlord of the inn, a jovial, managing fellow, volunteers to act as their guide. To pass the time pleasantly as they travel on horseback at a walking pace, he proposes that each pilgrim shall tell two stories on the way to Canterbury, and two on the return journey. Whoever tells the best story, the landlord being the judge, is to be entertained at supper by the rest of the company when they return to the Tabard.

The poet describes each of the pilgrims, and writes the stories they tell, but only twenty-four. Before they reached Canterbury the tales broke off, owing to the poet's death, and we do not hear which story won the prize.

In these tales, supposed to be told by all kinds of people, the manner in which people lived in the Middle Ages is unrolled before our eyes like a vast panorama. We see it just as it was, sometimes gentle and romantic, sometimes brutal, cunning, and vulgar, with good and evil so mixed that we do not know whether to laugh most or lament most at the sight. You can feel that Chaucer greatly enjoyed telling these stories, for all the while he was full of fun and high spirits. He could not help making fun of himself, as when called forward to tell his own story, he started a long, romantic rhyme of love, "Sir Thopas," such as he had in his youth translated from the French, and the landlord stopped him abruptly by exclaiming, "No more of this!"

What a mixed company it is that gathers under the guidance of the jolly innkeeper! There is the knight, who has ridden through many lands to fight for love and chivalry and honor, freedom and courtesy, and who yet, in his bearing, is "as meek as is a maid." With him is his

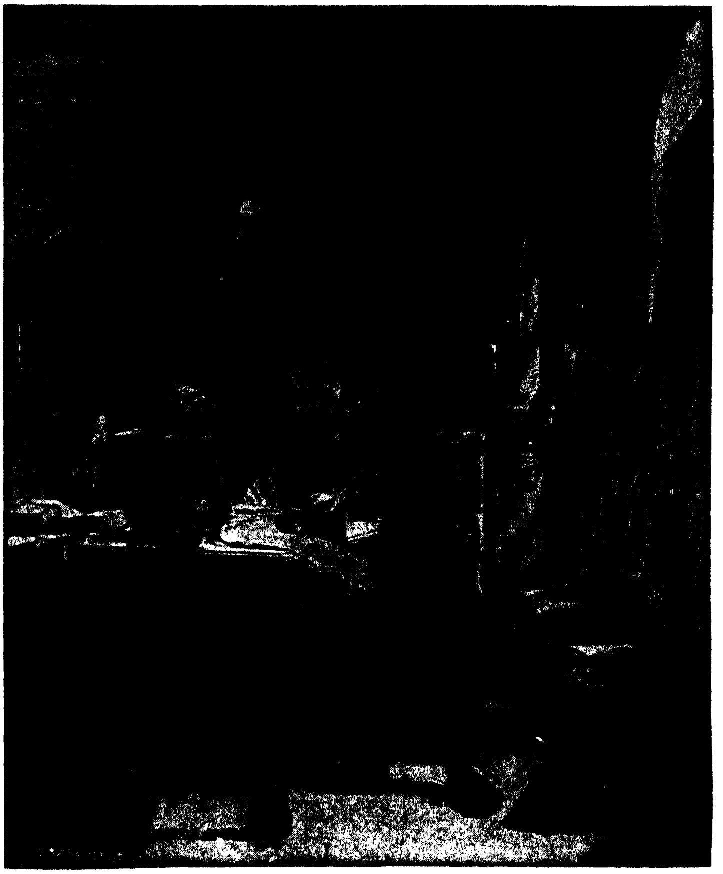
son, a curly-headed lad of twenty, his dress as gay as a flower garden, his mind full of love and romance, but not in sadness, for—

"Singing he was and fluting all the day,
He was as fresh as is the month of May."

As a squire the young man has "borne him well" in France and the Low Countries, and, like the knight, is a gentleman in heart and bearing.

"Courteous he was, lowly and serviceable,
And carved before his father at the table."

The knight and squire are attended by an honest yeoman, bow in hand. The Church contributes a group of characters, the chief among them being a prioress, who is a model of the best manners of the day, eating with cleanness and delicacy, and wiping her lips carefully "when she drunken hath her draught." Besides, there is a worldly-minded, sport-loving monk; a wandering friar, the best beggar in the whole countryside; a red-faced tax-collector; a pardoner; and a devoted parish priest, who, staff in hand, walks in all weathers from end to end of his parish, visiting great and small in their sickness, teaching Christ's Gospel, "but first he followed it himself." Though poor, this parson is "rich in holy thought and work."


Tyndale Translating New Testament into English.

"Benign he was and wonder diligent,
And in adversity full patient,
To drawen souls to heaven by fairness,
By good example was his busyness."

The professions provide a doctor, with more than a suspicion of quackery in his talk; a lawyer, who is not so busy as he tries to appear; and a pale, threadbare student from Oxford, who would rather have books than gay clothes. His mind is bent wholly on study, and he speaks with well-formed sentences.

"Sounding in moral virtue was his speech,
And gladly would he learn and gladly teach."

The landed classes sent to the pilgrim group a farmer; commerce sent a merchant; and among the rest were a miller, a ploughman, a sailor, a carpenter, a weaver, a dyer, and a wife of Bath, who had been married five times. The whole range of manners of the times, of good taste and of bad taste, is covered by these living figures.

Most of the tales were borrowed from Italian writers, but in turning them into English Chaucer gave them freshness and even new meanings. Good nature and a quiet humor played over all his writing, but he taught serious natural duties like contentment:

"Look up on high, and thank thy God for all,"

and a still loftier duty of faithfulness to the best thoughts that visit us:

"Hold the high way, and let thy soul thee lead."

Caxton, who printed books in the English tongue seventy-seven years after Chaucer's death, printed some of the poet's works seventy-eight years after his death, and introduced them by saying: "We ought to give singular laud (praise) unto that noble and great philosopher who may well have the name of laureate-poet." With that judgment all later users of the English language agree, for Geoffrey Chaucer not only wrote pleasant poems, but pictured the people of his own day, and helped to fix our tongue, which had been changing constantly.

THE TALES TOLD BY THE COMMON FOLK

While Chaucer was writing poems for fashionable people to read in expensively copied books, the common folk were telling each other tales in ballads—simple rhymes, often stumbling along. Then again they move our hearts with strong, clear picture-words, or haunt us with recurring phrases or refrains. When printing was invented these ballads were among the first poetry circulated everywhere, and one set, that told the story of the bold outlaw Robin Hood and his merry men, was so well known that a poet, Michael Drayton, writing a century later, said of Robin:

"In this our spacious isle, I think there is not one
But he hath heard some talk of him and Little John."

We can read, as an example, the ballad recording the tradition that Robin Hood was bled to death, when ill, by a treacherous kinswoman, the prioress of Kirklees, or Kirkley, nunnery. It shows how limping the metre often was, and yet how sad, how vivid, and how powerful the simple verses became when feeling was strong in them.

VOIAGE AND TRAVAILE OF SIR JOHN MANDEVILLE

There were other writers of English about Chaucer's time of whom we shall speak, but first we must go back to a very famous book, the "Voiage and Travaile" of Sir John Mandeville. This book, however, was not written in English. It was written in French about the time that Chaucer was a page. For centuries people thought that the book had been written by an Englishman, Sir John Mandeville, but scholars now tell us that it was written at Liege by a man whose name was Jehan de Bourgoyne. He was generally known as Jehan a la Barbe, and was probably a physician. He may not have been an Englishman at all, but it is possible that he was, and that he had to go into exile for a political offence. It is certain that the author of the book had been a great traveler for his time, and that he had been in Egypt. For a long time, it was thought that the author himself translated his book into English, and although we do not now think that he did this, we still speak of it as an English book, for it was translated by some one, probably in the lifetime of the writer, and certainly in the lifetime of Chaucer. It is a marvelous account of travels in Egypt and Asia, and describes some things that the writer saw, some he could only have heard or read, and many things that he believed or imagined, but which never existed. It is thought that he died only a few years before the death of Chaucer.

JOHN GOWER, WHO LIVED WHEN CHAUCER DID

John Gower, who was one of Chaucer's friends, was a writer of English when Chaucer was a youth. He was probably about ten years older than Chaucer, and as he lived about eight years after Chaucer's death, he was an old man when he died. He was not a genius like Chaucer, and his poems are not interesting to every one, but he wrote good poetry, and always placed himself on the side of right. He too helped to settle the form of the English language, a work that had already begun before his time, although it was not finished until about Shakespeare's day.

Gower was born about 1330, and died in 1408. In his youth he wrote in French and Latin, but in his later years, he wrote in English.

It is possible that Chaucer also knew John Wycliffe, for Wycliffe lived under the protection of John of Gaunt. John Wycliffe was born in Yorkshire about 1320 and died in 1384. He went to Oxford University, where he studied at the famous Balliol College, and became a priest and, for his time, a very learned man. He was noted in his early days as a philosopher, and is famous in history

as the man who may be said to have begun the movement which is known as the Reformation of the Church. He wrote sermons and tracts on the state of the Church, and his writing is chiefly of interest to students of history and English literature. But he was one of the writers who, in the fourteenth century, helped to accustom people to read in their native tongue, and so helped to create a demand for books in English. As we have learned on page 773, Wycliffe probably directed the first full translation of the Bible into English, and it is probable that he translated some of it himself. No fewer than 170 manuscripts of his version are still in existence.

THE VISION OF PIERS PLOWMAN

A very famous poem has come down to us from Chaucer's time, of which we must not forget to tell. This is the "Vision of Piers Plowman," from which we have learned much of what we know about the sadness and misery of the lives of the poor people of that day. It is written in the form of a vision or dream, and deals severely with the sins and evils of the time. Although it was written about the time that Chaucer was writing his poems, a larger number of the words used are strange to our ears, and it is much more difficult to read.

We know nothing, except what the poem tells us, about the author and his life, and indeed it may have been written by more than one person. It is generally believed, however, that at least the most important part was written by a man named William Langland, or Langley, who was born before Chaucer, and died in the same year that Chaucer died. It is thought that he lived at some time of his life in London, but he also knew the country well, else he could not have written as he did of the life of the people. He was probably a priest.

HOW CAXTON SAVED THE STORY OF KING ARTHUR FOR THE WORLD

It is interesting to remember that although books on religion, history and science and law were written in prose, nearly every story that has come down to us from the time of which we have been reading, was written in verse. Perhaps men had not yet gained enough skill in the use of their language to write stories in prose and make them interesting. Perhaps they had not gone far enough away from the time when stories were not written, but were sung by minstrels to the music of their harps, to make an attempt at writing stories in prose.

Chaucer himself wrote some prose. Two of the Canterbury Tales are in prose. He translated a little book called "The Consolations," by Boethius, a Roman philosopher, and he wrote a scientific treatise for his son, whom he lovingly calls "Litel Lowis, my sone," and commends for his ability to learn the science of numbers and proportions, and his love of knowledge. The poet shows himself to us here as a loving father, proud of his little son; but he has not left us a model for prose writing. Latin was then the language universally used by scholars, who corresponded with one another in it, and wrote learned books in it, because it was understood by every man who went to college, or was taught in the monastery schools. English prose writing was left to less learned men, and though, in the course of a century and a half after Chaucer's time, it became beautifully clear and simple, the progress at first was very slow.

It is not until about seventy years after Chaucer's death that what may be called the first real book in English prose was written. This is the "Morte d'Arthur," which was written by Sir Thomas Malory.

It might not have come down to us if William Caxton had not been so moved by its charm that he saved it for us by printing it on the press which, as we read on page 776, he set up under the shadow of Westminster Abbey.

AN UNKNOWN MAN WHO WROTE A VERY FAMOUS BOOK

We know nothing about Sir Thomas except what he has told us himself, that his book was ended in the ninth year of the reign of King Edward IV of England. "Morte d'Arthur" has come to us only through Caxton's printing. The manuscript copies are lost. In it Malory tells, in clear, simple, romantic, and enchanting English, all the legends that cluster round the memory of the British King Arthur, and it remains to this day one of the loveliest books of all the literatures of the world, a storehouse in which the poets, from Milton to the present, have sought for themes.

As the years passed, the Bible, with its nobility of thought, its unrivaled variety of style—narrative, history, drama, impassioned oratory, purest poetry, and

simplest talk—became the text-book of the people.

WILLIAM TYNDALE, WHO TRANSLATED THE BIBLE INTO ENGLISH

For many years, people were satisfied with the translation of the Bible which had been made in Wycliffe's time. But as time went on, it was seen that the translation was not good, and a priest named William Tyndale commenced to translate it anew. William Tyndale was born about 1492, nearly a hundred years after Chaucer's death. Like Wycliffe, he went to Oxford University, where he took his degree, and afterward went to Cambridge University, where apparently he studied for some years.

He commenced his translation about the year 1523, but after he had been at work for some time, he found that he would not be allowed to publish it in England. He, therefore, went to Germany, and lived for a time at Cologne. Then he went to Worms, and when he was threatened with arrest at Worms, he went to Antwerp. He worked hard for years at his translation, and part of it had been printed, but in 1535 he was arrested on a charge of heresy, and the next year, he was put to death. He had not finished the work that he had set himself to do, but he had done a great work. The translation he had begun so well was finished by Miles Coverdale, and was used as the foundation of the great translation made in the reign of James I, which we still use and love.

Another writer whom we must mention here is Sir Thomas More, the author of "Utopia," a book on the government of men, and how they should live together. It is a thoughtful work, and some of the ideas which the writer expressed have in our own time been actually made to work. It is the story of an imaginary island republic, in which every one worked, all the people were happy, and the time not spent in labor was used in the improvement of their minds.

Thomas More, the writer of "Utopia," was about fourteen years old when America was discovered. Like his father, he became a lawyer, and was so distinguished in his profession, that he was made a member of the king's council. Henry VIII showed him great favor, and made him lord chancellor when Wolsey fell from power. But though Henry took delight in his wise counsels, Sir Thomas shrank from friendship with the king, for he knew the dangers to be feared from his fickle-mindedness. His forebodings proved to be true. Because he did not approve of the king's acts, Henry had him arrested for treason, and he was tried and beheaded for an offence which he had not committed. His famous book "Utopia" was written in Latin, and though he wrote many books, we cannot call him a great writer of English.

With the exception of Sir Thomas Malory and Tyndale, and perhaps Miles Coverdale, there are no writers of English, whose names are worthy of being singled out, during the fifteenth and the early part of the sixteenth century. During all this time people were gaining too much new knowledge to do great writing. What is called the New Learning had begun to filter through Europe. The navigators sent out by Portugal and Spain made great discoveries. Everywhere men's minds were waking up to the fact that there were things to learn and beauties in the world of which their fathers had had no idea in the older days.

At first they were almost afraid of the new knowledge, and then their minds were so filled with the wonder of the truths and facts that they had learned that they could scarcely express their thoughts in words. It was not until late Tudor times, when all this learning had become absorbed and been made part of the national life, that the great poets burst forth into the songs that ever since have been the glory of our English tongue.

Meanwhile the language was gaining in strength and dignity. "Utopia" was translated in 1550, by Ralph Robinson. About the same time the beautiful Book of Common Prayer of the English Church was compiled and put into English, and in the religious disputes of the times the great preachers learned to write their sermons or homilies with an earnestness and sincerity that gave nobility to their work.

When Chaucer died, in the year 1400, English poetry had attained a charm unknown in prose. When Queen Mary came to the throne, in 1553, English prose had acquired a grace, sweetness, and strength that it has scarcely surpassed since, while in poetry a stately edifice has been built on the plain foundations that Geoffrey Chaucer laid.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 4029.

ALONG A COUNTRY ROAD

CONTINUED FROM 3896

YEARS ago, when the writer was a boy, he read a story which told of a long walk which two boys had taken. When they were questioned about it, one could remember nothing interesting. The other, who had gone over nearly the same ground, was full of the wonderful things he had seen. One boy had been trained, or had trained himself, to observe, while the other passed through the world without seeing the wonders around him. Which do you suppose got the most pleasure out of life?

Not so many years ago, most Americans lived in the country, or in the small towns from which they could easily walk into the country. The cities are now growing to be so large that many children seldom see the real country. Parks are sometimes very beautiful, but they are not the country. Many of our boys and girls who own THE BOOK OF KNOWLEDGE live where they can get out into the woods and fields, and many others spend their summers in the country. Let us all take a walk and see what we can see.

Some of the things we shall show you cannot be seen on the same day. Some of our pictures were made in the spring and others in the late summer. Then, too, boys and girls are reading this story in places very far apart. Some are in New England, some are in Canada, some in the South and some in the West. English boys and girls read our book, and so do boys and girls in Mexico, Alaska, the Philippines, and the West Indies. Many of you will recognize the pictures we show you. Others cannot see quite the same things, but something very like them.

COWS DIFFER MUCH FROM ONE ANOTHER

Nearly all of you have seen the cows going home from the pasture to be milked, but have you ever noticed how much difference there is in cows? They are quite as different as human beings. There is the cow that minds her own business. As soon as the pasture gate is opened or the bars are let down she starts straight home and does not turn to the right or the left. Another cow tries to turn down every path she crosses, just like a naughty boy, and another suddenly becomes very hungry, and stops to eat, though the grass in the pasture was better than that by the road.

All New England boys and girls have seen roads like those on page 3946. Everywhere in New England one finds bits of road or village street, where the branches of the trees meet above and make a beautiful arch. Generally the trees are elms, but not all the oaks in New England have been cut down, and you may find buttonwoods, maples and poplars too. When

the sun is hot, is it not pleasant to stop and rest in a place like this? While sitting or lying on the grass, you may see dozens of interesting things. Caterpillars are climbing the tree trunks to eat the leaves. Do you remember how the carelessness of one man let loose the gypsy moth, which has done so much harm? Hundreds of fine trees have been killed, because a tree cannot breathe without its leaves. You may watch the busy ants, red and black, as they hurry along. But you must be careful, for poison ivy grows freely by the roadside, and you may suffer if you are not careful. The harmless Virginia creeper is common, too, but if you will remember that the ivy has only three leaves, while the creeper has five, you may save yourself pain.

WHAT YOU MAY SEE IN THE LITTLE POND

The little pond beside the road is full of life. Tiny fish dart here and there and a great dragon fly hovers over the water. Did you see the big green frog before he jumped into the water with a splash? On the trunk of the tree which has fallen into the pond you may often see turtles sunning themselves, or you may find a tortoise crawling along the dusty road. When he sees you, in go his head and tail, and you must wait a long time before he peeps out. Perhaps you may see the brilliant cardinal flower, or the blue flag growing beside the pond or on the banks of a ditch. In marshy places the fringed gentian grows. Do you know Bryant's poem on this flower, which you can find on page 4899?

The roadsides present an ever changing array of flowers, if too many people have not passed along and picked them. The ox-eye daisies you know, the buttercup, the dandelion, and the wild carrot, too. Then you can recognize the asters, purple and white, in the late summer. Do you know the curious Indian pipes, which grow in open woods? There are dozens of others which you can learn to know from other stories in our book. Nothing gives more pleasure than to know the wild flowers of the road and meadow.

Have you ever tasted the delicious blackberries picked from a high spray, where they can get the sun? Do you know that the red ones are "green" and that only the rich purply-black ones are ripe? The British blackberries are seldom so good as those in this country. Have you ever picked and broken open the chestnut burrs which have fallen from the tree, and found the glistening brown nuts packed in their velvet caskets? In the South the boys and girls pick chinquapins, which are small roundish nuts, covered with prickly burrs like the chestnuts. The chinquapin tree is only a shrub. All of you have picked up hickory nuts, I am sure, but the black walnut and the butternut are growing scarce now because the timber of the trees is so valuable.

In the low places beside the road the ferns no longer cling to the ground but stand up straight two or even three feet. One can think what the earth must have looked like thousands of years ago, when ferns grew as tall as trees, and then were buried slowly to change to coal. Do you know the difference between the ferns? There are dozens of different kinds, but none is more lovely than the graceful maidenhair. All New England boys and girls know the sweet fern, which is really not a fern at all, though its leaves are fernlike.

BIRDS AND BEASTS YOU MAY SEE ON A COUNTRY WALK

If you have kept your eyes open you have seen dozens of living things. Perhaps a cardinal or a scarlet tanager has flitted across the road. Sometimes one hears a blue jay scolding or sees him in the trees. A dainty humming-bird hangs suspended before a flower. Late in the summer or very early the fields may be covered with blackbirds going North or South. The friendly robin appears early in the spring. Our English readers see their robin hopping about, but he is quite different from the robin one sees in the United States and Canada. Then there are always quiet birds that move noiselessly through the branches. Perhaps you can find a sparrow's nest with its speckled eggs in the shrubs beside the road. I do not mean the noisy, impudent English sparrow, with his dirty, slovenly nest, but the well-made home of the daintier members of the family. We show you some birds in their natural colors in another place. The quail, or bob-white, you surely know, and have heard his call, but have you ever seen the tiny quail only a few days old? Sometimes you may see them if you are quiet. When alarmed they squat where they are and sharp eyes are required to discover them.

When you have seen a wild squirrel in the trees you will think the fat squirrel in the park looks clumsy and awkward. Did a rabbit ever run across the road in front of you? Have you ever seen a little baby rabbit? Sometimes it does not try to run away, but crouches down, thinking it will not be seen. It takes sharp eyes to find it then, but sometimes it will let you pick it up. Perhaps it is paralyzed with fear. Sometimes you may see one of the flesh-eating animals, a weasel, or a mink. One day, while sitting quietly under a tree, the writer saw a mother skunk with four or five baby skunks tiptoe across the road.

THE CLEAN LITTLE PIGS IN THE PASTURE

The pastures are full of interest. Pigs are always amusing, and you may see white pigs, black pigs, red pigs, and spotted pigs. Do you know the different breeds? One who knows can tell you about them. These are Berkshires, one of the best breeds. Little pigs run around rooting with such important airs. Do not try to touch one, though, if the mother pig is close by, for she will fight like a tiger for her babies. A mother horse is usually more sensible. She does not think that any one is likely to harm her colt, and he is likely to be very friendly, and may come up to the fence to be patted. A mother horse will fight for her foal if necessary however.

That horse you see rolling upon the ground is not sick, but is wallowing. Why it does so no one knows, but all horses like to throw themselves upon the ground and roll over. Did you notice how it got up? Horses always get up on their fore legs first, but a cow stands on her hind legs while still resting on the knees of her fore legs.

Perhaps you will come to a farmyard, and it is always interesting. Turkeys strut around as if they owned the place, and the geese waddle about and hiss. Guineas are not very common but they are sometimes seen. This fowl has not really been tamed, but is still half wild. Do you know the different breeds of chickens? In another story we show you some colored pictures of chickens, and the town boy or girl can easily learn some of the more common ones.

Sheep are often seen in these pastures, and may come crowding up to the fence or wall, though they are more likely to pay no attention to you, unless you come too close. Then one starts running and all follow. In the spring, the little lambs play around, but the older ones seem to eat all the time. After shearing, they look lean and ragged, but their coats may be your coat by and by.

EVERY SEASON HAS ITS OWN SIGHTS TO SHOW

Every season has its pleasures in the country. After the winter we are sure that nothing can be more beautiful than the spring, when the tender green of the trees seems to hang like a veil over them. You can see the plough, pulled by two or four horses, turning up the warm brown earth, and burying the sod. You have all seen the ordinary plough, cutting through the earth like a boat through water; but you may not have seen the plough like the one we show. It is a disc plough and does good work.

Summer brings its own sights too. The leaves of the trees are full-grown, and flowers are everywhere, though the flowers of spring have gone, and there is a delicious rich smell in the air. Do you hear the clack of the mowing machine on the other side of the field? Notice how the grass falls before the blade. There is no odor more delicious than that of new mown hay. The next day, perhaps, if the weather is fine, men may be loading the hay into the wagon. Have you ever ridden on the top of the springy load?

Autumn, or late summer, is interesting also. There are not so many flowers, but the bright fruits and seeds almost take their place. The leaves are changing to scarlet and gold. Do you know whether that tree which stands out so clearly like a flaming torch is a maple or a liquidambar, better known as a sweet-gum?

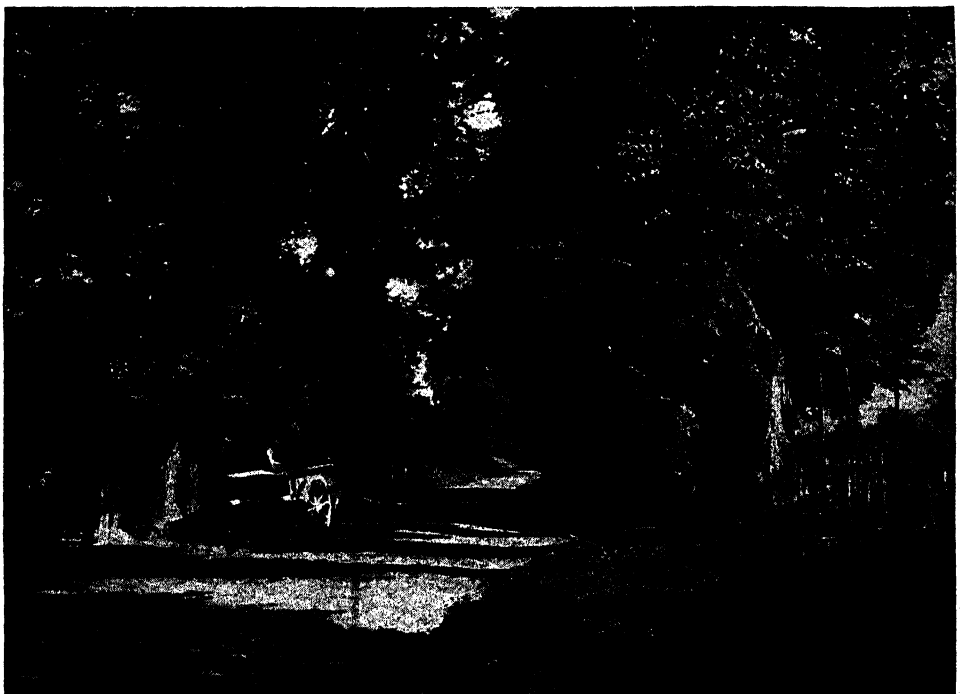
Many of our readers have never seen the country in winter, but it is interesting, too, though none of our pictures here show it to you.

These are only a few of the things some one or other of our boys and girls may see on a walk along a country road. If you learn to use your eyes, you will always have a good time in the country. Beast and bird, insect and flower are all there in many forms if you will only look, and look quietly. On one hillside, a lady the writer knows found over three hundred different wild flowers.

THE NEXT NATURE STORY IS ON PAGE 4013.

THE SIMPLE BEAUTY OF A QUIET LANE

The poet tells us that "God made the country and man made the town," and though we may see the roadman at work in a country lane, the beauty and calm make us feel the truth of the poet's sentiment.



Some country roads have a beauty all their own. Flanked by magnificent trees, nodding beeches, graceful elms, massive oaks, and tall, waving poplars, they present a scene like a picture from paradise.

A PARADISE OF LIFE AND COLOR

A little pond beside a lane may not have the unceasing motion of the torrent, or the dancing movement of the brook, but let a stone be dropped on its placid surface and the water is instinct with the spirit of life.

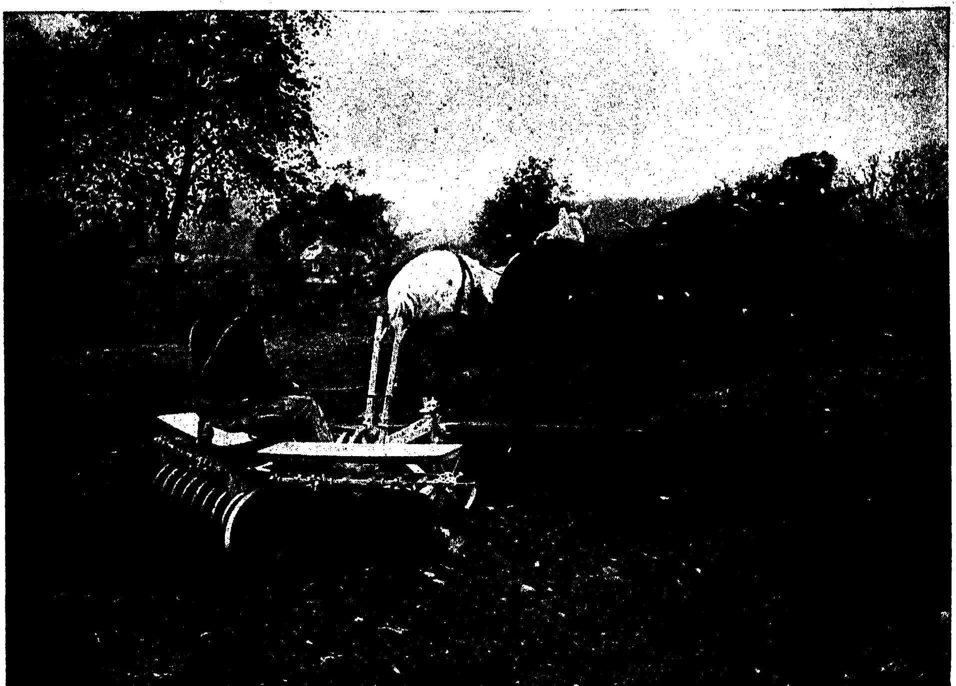
From spring to autumn the roadsides and hedgerows of New England, "sunny spots of greenery," are lined with mingled blossoms, where, as a poet has written, "the raptured eye hurries from joy to joy."

SHADY NOOKS BY THE SIDE OF THE LANE

Every here and there, by the side of the road, we find a delightful spot like this, where we may gather nuts in the autumn. There is a peculiar pleasure in reaching after the nuts that are so near and yet so far.

A ferny nook like this tempts us to turn aside from our walk in the country road, and to roam in the shade, wandering among the bracken that grows so picturesquely beneath the trees. It is always cool among ferns.

GLIMPSES OF LIFE IN THE COUNTRYSIDE



This is a curious plough, or harrow, which you see sometimes in the country. It is used on land which has already been ploughed in order to cut up the clods and lumps more thoroughly, so that the air can get into the soil. The plants grow better when the soil is light and fine around their roots.

When the "ploughman homeward plods his weary way," it is usually with his horses, and the scene in this picture is a familiar one in the country when ploughing has begun in earnest.

The photographs on these pages are by Percy Collins, W. Reid, R. W. Copeman and Brown Bros.

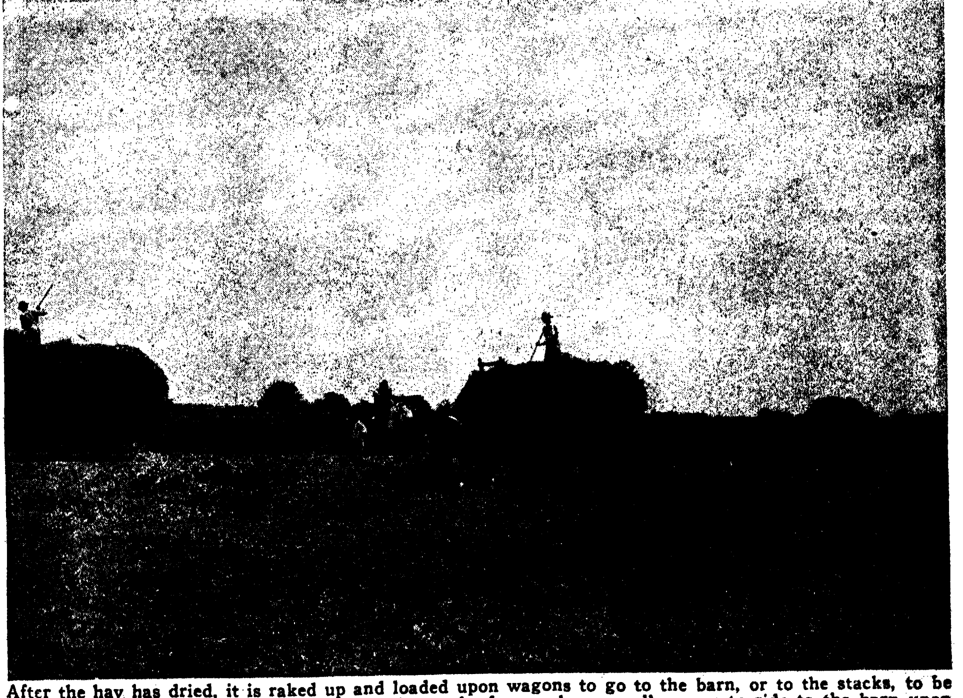
PEEPS OF THE FIELDS FROM THE LANE

Not only in the lane is there much to interest and delight us, but as we look over the fence, or through the hedge, we see sights like this. Pigs in clover are always happy, although they cannot be called pretty.

Perhaps we may seea horse with its foal. And, surely, of all the pretty sights to be seen in the country, none is quainter than this! The foal seems so very funny with its long legs out of all proportion to its body.

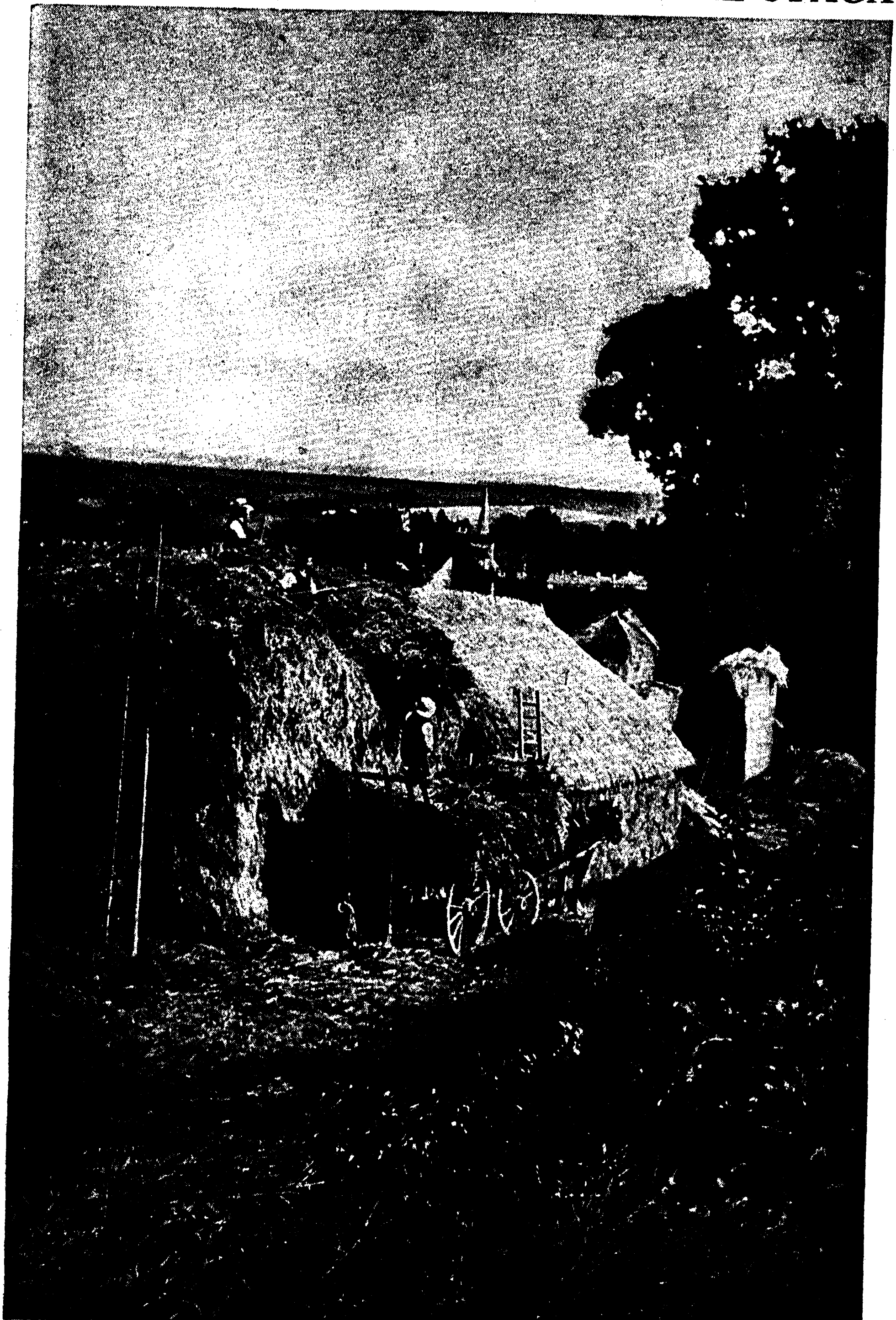
CUTTING AND LOADING THE HAY

The haymaker with a scythe is more picturesque, but the mower does much more work. You can see the blade as it stretches out into the edge of the grass. When the horses start, the grass falls steadily before the moving blade. The odor of new-mown hay is one of the most delicious scents of the fragrant summer, which has so many delightful surprises for the city boy or girl who can go to the country then.

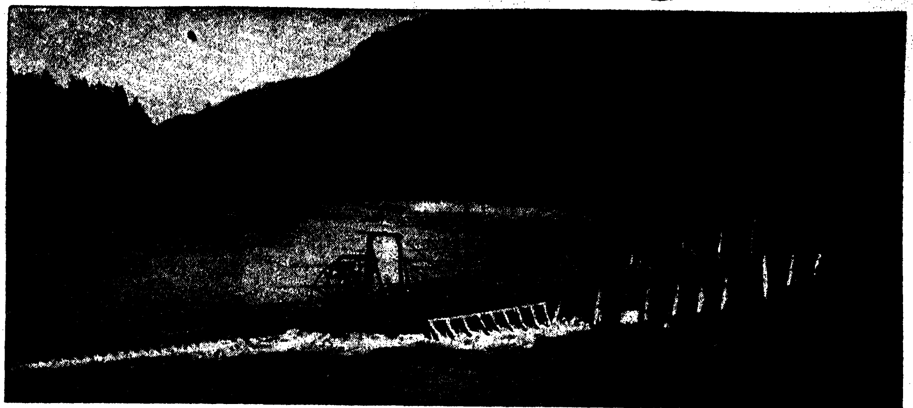


After the hay has dried, it is raked up and loaded upon wagons to go to the barn, or to the stacks, to be kept until wanted. If you have learned to know the farmer, he may allow you to ride to the barn upon the load. It is as springy as the best chair you ever sat in, and the sensation of motion is delightful. Pictures in this page and the top picture on page 3949 by Brown Bros.

PUTTING THE LAST LOAD ON THE STACK



There is no more delightful sight in all the countryside than a scene such as this, where the last load of hay is being put upon the stack, and the harvest is about to be completed. Such typical farming scenes are, however, fast disappearing, for even the unloading of the wagon and building of the stack are now done by machinery.



WHEEL FOR CATCHING SALMON ON THE COLUMBIA RIVER

THE OCEAN WEALTH OF CANADA

CONTINUED FROM 3737

CANADA is fifth among the countries of the world in the value of fish caught and sold. That does not give her a very high rank, but you must remember that the population of the Dominion is small, and so to Canadians the industry is much more important than it is to the people of most other countries. The value of the fish—including lobsters and oysters—caught by Canadians is about $33,000,000 a year. Nova Scotia and British Columbia have the most valuable fisheries.

DOUBLE CONTROL OVER THE FISHERIES

In Canada, the Dominion Government and the provincial governments share the control over the fisheries, and this has caused a great deal of trouble; for, until quite recently, a fisherman could not be sure to whom to go for permission to do what he wished. This difficulty has now been settled, or is being settled, but, in the meantime, a great deal of harm has been done and the fisheries have suffered very much. This is one reason, among others, why the value of the fishing catch has not increased as it should.

Most of what you have been told about fishing in Newfoundland is true about the cod and herring fisheries along the Atlantic coast of Canada, so that what I shall tell you here is in addition to what you have already read, or may read, in the article on Newfoundland. Cod and herring are both caught on the Pacific coast. The Pacific coast cod fishery is not important, but the herring fishery of this coast is of growing value. The Pacific coast cod is the same as the cod of the Atlantic, and it is supposed that the fish come down through the Arctic. The herring of the Pacific is not quite the same as the herring of the Atlantic, but it is very closely related.

SALMON IN BRITISH COLUMBIA

The most important of all Canadian fish is the British Columbia salmon, because the value of the salmon caught there is even greater than the value of the cod caught on the Atlantic coast by Canadians. This salmon is not a true salmon at all for, unlike the salmon of eastern America and other countries, it dies shortly after spawning. In spite of this, I shall call it a salmon, as that is the name it commonly bears.

Vast schools of these fish come in from the sea and swim up the rivers to their spawning grounds, and it is at this time that they are caught in great quantities. Nobody knows

much about the way in which they live or the food which they eat while they are in the ocean, as they seem to prefer the deep water, where it is not easy to study their method of life. But when the call sounds, they start for the shore in myriads and ascend the rivers, jostling one another on the way, dashing up the rapids, leaping the falls, all in mad haste to reach the spawning grounds. We may read more about these interesting fish in the story of Fish of the Rivers and Lakes.

THE DIFFERENT KINDS OF SALMON IN BRITISH COLUMBIA

The kind which is most used for canning is called the Sock-eye. It is rather small, for a salmon, and weighs from three to ten pounds. Its flesh is of a deep red color, and that is the principal reason why it is preferred to its brothers. The number of these salmon is greatest every fourth year, and this difference in the "run" is seen best in the Fraser River. Why there should be three lean years, followed by a fat year, no one knows, but such is the case.

The Spring or Quinnat salmon is the largest of all, and weighs from eighteen to thirty pounds. This is the boldest and strongest of them all; but in Canada it is not used so much for canning, because the flesh of many is white and not so pleasing in color as that of the Sock-eye. Often, however, it is quite red.

The Coho is about the same size as the Sock-eye, and is used for canning to a greater extent than was formerly the case. This is the kind of British Columbia salmon which people in the east of North America know best, for it is sent in ice to places which are as far east as Boston. Of course, it is desirable to get it to market as soon as possible, and the cars in which it is carried are sent east either as fast freight or they are attached to passenger trains.

The Dog salmon is called by that name, because the teeth of the males at the spawning season are shaped a little like a dog's teeth. These fish are caught in large numbers by the Japanese living in British Columbia. The fish are salted and dried, and sent to Japan and China for sale.

The last and least important of the different kinds of salmon is the Humpback, which gets its name from the odd hump on its back. It is rather a small fish and weighs from three to six pounds. The "run" is much larger every other year. It is a fish that is not considered very valuable, and the catch is quite small.

WHERE THE HALIBUT AND HADDOCK COME FROM

The halibut fishery comes next in importance to the herring fishery. Large quantities of halibut are still caught in the Atlantic Ocean; but the fish have become fewer in number in the western seas and fishermen have to go much further north, and further out from land to find them. At the same time the value of the halibut fishery on the Pacific coast has increased, and the greater part of the halibut which is sold in the eastern markets of Canada comes from the fisheries off the coast of British Columbia.

As we have learned in another place, halibut is a flat fish. It lives at the bottom of the ocean and loves best the cold water of the deep seas of northern regions.

The haddock, which is a member of the cod family, also adds to the wealth of our Canadian fisheries. It is fished for in the same way as the cod, and indeed large numbers of haddock are caught in the same nets as cod. It does not go so far north as the cod, and no haddock is found in the Pacific Ocean. This fish is usually smoked and dried, and Canadians who live inland know it best as the toothsome "finnan haddie" of our breakfast tables.

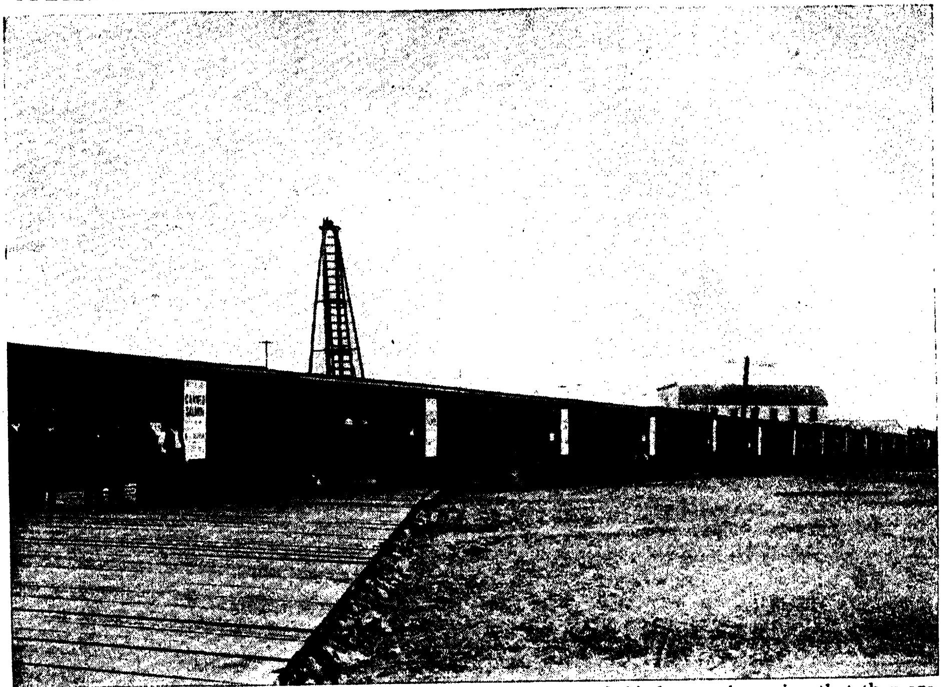
SARDINES ARE CAUGHT IN CANADIAN WATERS

We usually think of sardines as coming from France; but the fact of the matter is that a large number of the sardines which we buy are caught in our own waters. Although they are much smaller than herrings, sardines belong to the herring family, and are caught in nets with small meshes.

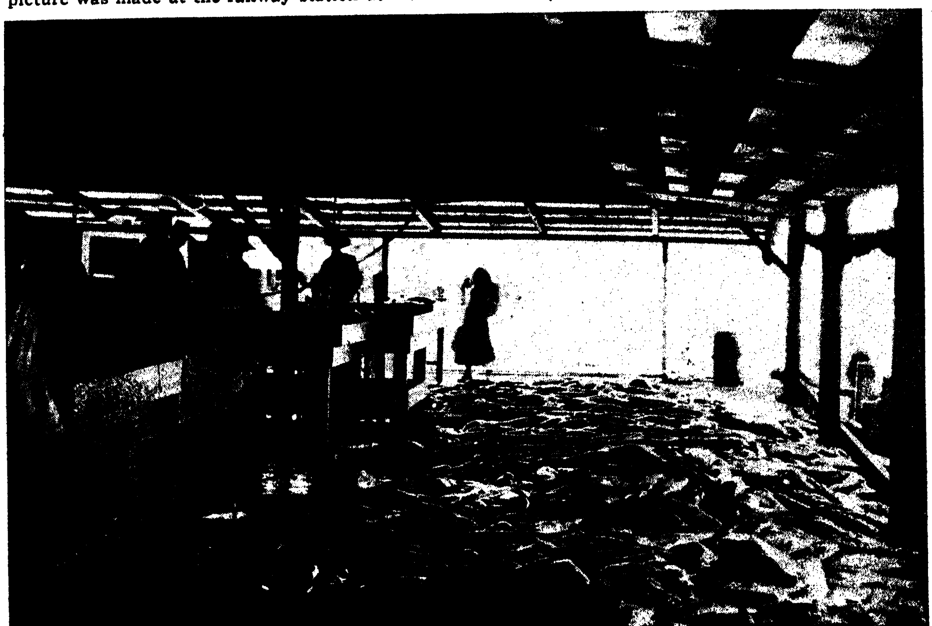
After they are caught, they are washed and dried. They are then soaked in boiling oil and packed into boxes so tightly that we use the packing as a proverb, and speak of things or people as "being packed like sardines" in a tin. After they are packed, and every space in the tin is filled with oil, the tin is soldered up, and the fish is then cooked by boiling the tin.

Hundreds of thousands of dollars worth of these little fish are caught by Canadian fishermen every year and cured.

SALMON BY THE HUNDRED THOUSAND



If you are inclined to doubt whether the posters on all the cars of this long train saying that they are loaded with canned salmon tell the truth, look at the picture below, and remember that it shows only a part of one cannery and that there are many others along the river, some only a few yards away. This picture was made at the railway station at New Westminster, a thriving town in British Columbia.



The Fraser River is the chief seat of the salmon canning industry in Canada and one of the leading towns is New Westminster. Here we see the salmon thrown upon the landing stage. The men and women, indistinct figures to the left, will clean them, and soon they will be encased in tin ready to start on a journey which may be across the continent or even to the other side of the world.

WHITEFISH FROM THE LAKES AND RIVERS

I imagine that most of you know something about whitefish, since they are so much liked for their delicate flavor. One of the early French explorers in Canada remarked that they were the only kind of fish of which one did not soon tire, for as a rule a continual fish diet is far from pleasing. The most of these fish in Canada are taken from the Great Lakes, although the lakes and rivers of the West are yielding a larger and larger supply every year. They are caught in numbers in Lake Winnipeg.

As a rule, they prefer shallow water, so that they are caught along the shores of the lakes. Nor do they stray very far from the place where they are accustomed to feed. The one exception is in Lake Erie, the shallowest of all the Great Lakes, where they are found even in the centre of the lake. Our duty is to enforce more strictly the laws for their preservation, and thus give the fish a chance in the unequal fight for their existence.

LOBSTERS AND TRAPS TO CATCH THEM

Lobsters are found along the Atlantic coast of the Dominion. They are caught in traps in which bait has been placed, and the traps themselves are anchored in rather shallow water near the shore. The traps are made of slats, through which the water flows freely. The entrance is through a funnel-shaped passage, with the large end facing outward. This makes it easy for the lobster to find its way in, but difficult for it to get out.

The lobster itself is a very hardy creature, which will live for a long time out of water if well packed in ice. It is in this way that a good many are taken to market. Most of them, however, are canned in some of the numerous factories along the Atlantic coast. As you probably know, the lobster is green in color when alive, but when covered with boiling water, the shell takes on the bright red color with which you are familiar.

DECREASE IN THE NUMBER OF LOBSTERS

The number of lobsters is becoming smaller each year, and many are the plans which have been made to meet the situation. In all cases, there is a close season, during which they may not be caught. Sometimes the space between the slats of the traps is fixed by law, so that the small lobsters may escape, and sometimes the fishermen are not allowed to catch the little ones. It is doubtful whether it is worth while to protect the small lobster, because it is the full grown female which lays the most eggs, and the bigger she is the more eggs she lays. I am sorry to add that the fishermen and lobster canners do not obey the laws very well, and so matters are in rather a bad way. Nevertheless the lobster fishery brings in some millions of dollars every year, and ranks, in value, higher than either the cod or herring.

OYSTERS FROM PRINCE EDWARD ISLAND

Canadians like to think that the best oysters in the world come from Malpeque, in Prince Edward Island. This may or may not be true, but the oysters which are found there are certainly very fine. They used to be so numerous that the farmers used them to fertilize their land. As a result of this and other things, they have become quite scarce in all the Maritime Provinces. They are found also on the Pacific coast, but the oysters there belong to a different family from those in the Maritime Provinces, and they are not nearly so large nor of such good flavor as their Atlantic cousins. Some of the Atlantic kind have been taken to British Columbia, and placed in the Pacific, but we do not know yet whether the experiment is a success.

THE INTERESTING STORY OF THE OYSTER

The life history of the oyster is very interesting. The egg itself, in the course of four or five hours, turns into the larva, as it is called. Both of these are so small that you cannot see them without a microscope, the egg being only 1-500 of an inch across. The larva swims about for a month or so, and then attaches itself to a stone or piece of shell, or any smooth surface which it may find in the water. In this state it is called a spat, and it does not become a full-grown oyster for four or five years. The only time that it can swim is during the month that it is in the larva stage, although an oyster is able to move about a little on the bottom of the ocean.

HOW OYSTERS ARE GATHERED FOR MARKET

Oysters are not caught in traps, because they do not move about, but wait

for their food to come to them. The oyster fisherman gets his catch by raking the bed of the sea, and the best place to find the victims is near the mouth of a river, or in a bay where the water is partly fresh and partly salt. The fishing is done with things shaped a little like large rakes or scoops, by means of which the oysters are scooped up and placed in the fisherman's boat.

This is a very clumsy way of fishing, but it is hard to see what other method can be used. And it is not only clumsy, but very costly, for thousands and thousands of spat and little oysters are killed in the process, and many full grown oysters are either crushed to death or smothered in mud. Considering the number caught and the much greater number killed in the spat stage, the poor things have a very hard time of it, as you can imagine, and it is no wonder that their numbers have become very much less. You may learn more about the habits of oysters and lobsters in the Story of Sea Animals in Armor in another place in the book.

THE ENORMOUS NUMBER OF FISH EGGS PRODUCED EACH YEAR

When you think of the enormous number of eggs that one fish will lay, you may consider it strange that the fish themselves are growing scarcer each year. The female oyster, for instance, yields about 16,000,000 eggs a year, but very few of these ever become oysters. Man is their worst enemy. Many of the eggs die almost at once, and many of the others, which become larvæ or spat, are eaten by fish or destroyed by fishermen in the way that I have showed you.

A lobster eight inches long will lay about 8,000 eggs. As the lobster grows larger, the number of eggs becomes greater. A lobster sixteen inches long will yield about 80,000 eggs, and larger lobsters, still more. But not more than one egg in ten or fifteen thousand ever becomes a full grown lobster, so numerous and destructive are its enemies in the sea. Of course, when the eggs are hatched in protected water and taken care of, the number of lobsters obtained from them is much greater. You will, therefore, see the necessity for hatcheries for all kinds of fish, and you will also see that we must obey the fishing laws, and make others obey them, if we want to preserve our fisheries.

HATCHERIES WHERE FISH EGGS ARE HATCHED AND CARED FOR

One of the best methods of increasing the number of fish is to protect the eggs and young fish from their enemies. The Dominion Government has established a great many hatcheries at different places in Canada for this purpose. Here the eggs of different kinds of fish are placed and hatched, and the little fish protected and fed until they are big enough to take care of themselves.

A hatchery is an interesting sight. One can see the eggs of various sorts of fish, the little fish just hatched, and can follow their growth, until they are ready to be placed in the lakes or streams to shift for themselves. Often the baby fish show little resemblance to the full grown specimens.

In the case of the oysters, the Dominion Government has allowed the Maritime Provinces to rent the oyster beds to people who will have the sole charge of them. This has proved a good plan in Maryland and other places, and ought to be a success in Canada, since anything which belongs to a particular person is likely to be cared for better than a thing belonging to every one, for every one's property is no one's. There is also a group of men in Canada who are interested in this and other questions about fish, and they advise the government what to do. These men are members of a section of the "Commission of Conservation," and they meet every year to talk over ways of protecting the fish.

The story of Captains Courageous, which you may read in another place, gives a good account of the perilous lives of the fishermen and the hardships which these brave men endure without complaint. It is true that it is a story of Gloucester fishermen, but life on a fishing boat is very much the same in all the northern seas, whether they are east or west, or whether they are north or south of the border line. Sailing vessels like the We're Here are gradually being replaced by steamboats and powerboats, which are not dependent on the winds for power to reach their havens. But when all is said, the difficulties to be met by the strong men who go out into the deep to fish are still great, and they face many perils, and meet great adventures in their dangerous calling.

THE NEXT STORY OF CANADA IS ON PAGE 4127.

FISH OF THE STREAM AND OF THE SEA

There are also multitudes of freshwater fish in Canadian streams and lakes. While, of course, many are caught for sale, thousands of men spend their vacations fishing in the woods. Successful business and professional men, accustomed to every comfort in their homes, throw themselves into the primitive life of the camp with real enjoyment. This picture is called " A Good Catch " and represents a morning's work, or pleasure, whichever you choose to call it.

Photograph by Notman, Montreal.

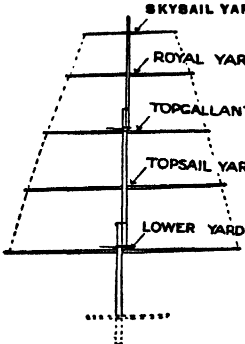
The fisheries of Nova Scotia are the most extensive of the Dominion, and Halifax exports large quantities of dried fish. The harbor, here shown, is deep, however, and warships may often be seen lying at anchor. In winter, when the St. Lawrence is frozen, the ocean-going boats, which in summer go to Quebec or Montreal, generally stop here. Halifax is well defended against possible invasion by the strong citadel. Since the beginning of the Great War Halifax has been a very busy place.

HOW TO KNOW SAILING SHIPS

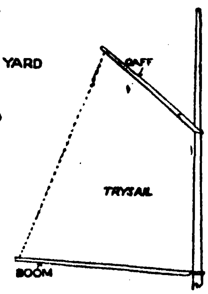
CONTINUED FROM 3903

TO hear men talk about sailing ships is sometimes very confusing. Many boys and even men who live by the sea, and see ships sail along the coast and come into harbor, do not know the names of the various kinds of ships, and cannot distinguish one kind of ship from another. They may hear sailors and other people talk about a schooner and a brig and yawl, but they cannot tell one of these things if they see one. There may be an excuse for this sort of ignorance if we have never had the opportunity of learning what the different kinds of ships are like, but there will be no excuse for *us* if we do not know them, because this article and the pictures in it have been specially prepared in order that we may learn many things worth knowing about the rig of sailing ships.

It is necessary to begin by understanding something about masts and sails. A mast is a long pole sticking upright, or nearly upright, in the ship and made to carry a sail, or several sails. The masts stick up through the deck. A mast is always tapered, its lower end is very securely fixed to the bottom part of the ship, and a rope, usually a wire rope—and sometimes more than one rope—has one end attached to the mast near the top, and the other end attached to the sides of the deck or to another mast. If there is only one mast in a ship it is called simply *the mast*. If there are two masts the front one is called the *foremast*, and the second one is the *mainmast*. If there are three masts the third is called the *mizzen-mast*, and if there is a fourth mast it is called the *jigger-mast* if it has no yards, and the *after-mizzen mast* if it has yards. We shall see what yards are presently. Masts for large ships are made in more than one piece, and these are fastened together as you may see in picture 1.



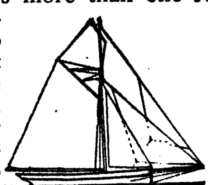
1. Yards.



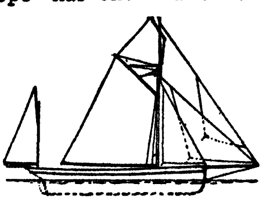
2. Trysail.

Every sailing ship has a *bowsprit*, that is, a spar sticking out in front in a horizontal, or almost a horizontal, position.

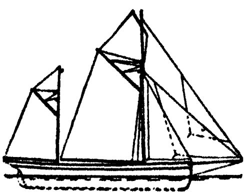
The sails could not spread out on the masts alone; there must be spars attached to the masts to assist in carrying the sails. There are three kinds of such spars, and they are called *yards*, as shown in picture 1, and *booms* and *gaffs*, as shown in picture 2. The yard is a spar that goes across the mast; from it and in front of the mast the sail hangs downwards. In its normal position the length of the yard is across the ship, but, of course, it can be moved around to any angle so as to catch the wind. The boom is a horizontal spar, and it stretches backwards from the mast towards the stern, or back, of the ship. It also can be moved around so as to



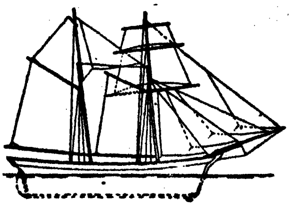
3. Cutter, or Sloop.



4. Yawl.

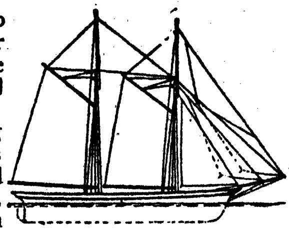


5. English Ketch.

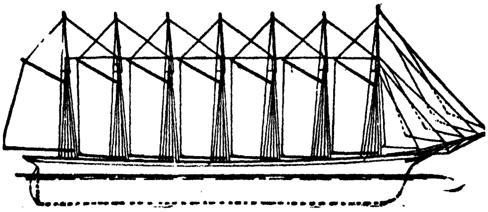


6. English Schooner.

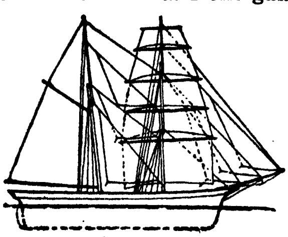
spread the sail to catch the wind from any quarter. The gaff is something like a boom, and it holds at the top the sail which the boom holds below. Its position is not horizontal; it slopes upwards towards its point. The spars on the masts are called by the names of yards. The foreyard is the yard on the foremast, the mainboom is the boom on the mainmast, the mizzen-gaff is the gaff on the mizzen-mast and so on. The sail between a boom and a gaff is called a *trysail,* or a *spanker,* and is illustrated in picture 2. A mast cannot have more than one boom and one gaff, but it may have several yards. The bottom yard, which is well shown in the first picture, is called the *lower yard,* or by the name of its mast, as *foreyard, mainyard,* etc. The one above it is the *topsail yard,* or if the topsail is in two parts, the two parts are called the *lower topsail yard* and the *upper topsail yard,* respectively. Above the topsail is the *topgallant yard,* or if the topgallantsail is in two parts, the two parts are called the *lower topgallant yard* and the *upper topgallant yard,* respectively. The yard above the topgallant yard is called the *royal yard,* and if there is one higher still, it is known as the *skysail yard.* Now, if we remember these points about masts and sails we are ready to consider the *rigs* of various ships.



7. Fore-and-aft Schooner.



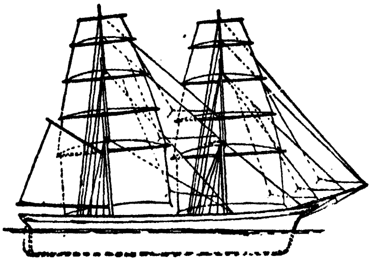
8. Fore-and-aft Seven-masted Schooner.



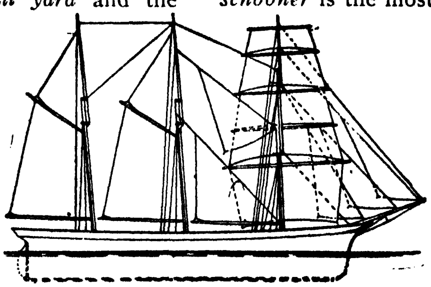
9. Brigantine.

The name given to the sails and their disposition on the various masts and spars is the *rig.*

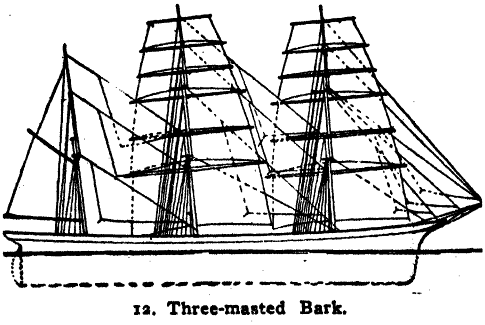
Small sailing ships and yachts have what is called the *cutter* rig, which is seen in picture 3; there is only one mast, and the *mainsail* is stretched between a boom and a gaff. In the United States this boat is often called a sloop also. Once there was some difference, but now both words are used to describe the same thing. The *yawl* is very like a cutter, but has a small jigger-mast at the stern, as seen in picture 4. The yawl is generally a little larger than a cutter. The *ketch* is like the yawl, but the rear mast is generally larger and further forward. It is seen in picture 5. The rig of the *schooner* is the most common on sailing vessels to-day, especially those which sail up and down the coast. Although steamers may not have sails at all, if they have sails these are the schooner rig. There are two kinds of schooner rigs: the ordinary schooner rig, and the fore-and-aft schooner rig. The ordinary schooner rig, which is seen in picture 6, has a foremast with a topsail and topgallantsail, but a trysail instead of a lower yardsail, and on the rear, or main, mast there is a trysail



10. Brig.



11. Barkantine.



12. Three-masted Bark.

13. Four-masted Bark.

and topsail. The fore-and-aft schooner rig, which is most common on this side of the Atlantic, has no yardsails but only trysails, which are generally uniform on all the masts. In picture 7 we see a two-masted schooner with fore-and-aft sails, and in picture 8 is shown a seven-masted schooner with fore-and-aft rig. A schooner may have as many masts as may be found convenient and still be a schooner. Some very large schooners have been built in the United States. If a schooner of the first-mentioned type has more than two masts, the foremast only has yards, the remaining masts having trysails only.

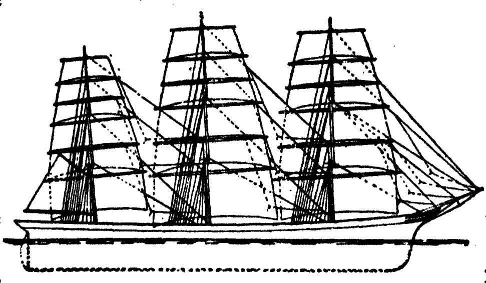
The rig of the *brig* is a rare type in these days. It is found only on two-masted ships, and, as seen in picture 10, it has a main, or rear, mast with yardsails and one trysail, and a foremast with yardsails only.

The *brigantine* and the *barkantine* are much alike. The brigantine has a foremast with yards and a mainmast with a fore-and-aft sail like a schooner. The barkantine is seen sometimes in three-masted sailing ships. It is as seen in picture 11, which shows that it is like the brigantine with a mizzen-mast added to it.

The most popular rig for modern sailing ships is the *bark*. It requires not fewer than three masts. The mast nearest the stern has a trysail, but the other masts have yards and yardsails. Picture 12 shows a three-masted bark, and picture 13 shows a four-masted bark.

For very large ships barks are sometimes made with five masts, in which case the front four are rigged alike with yardsails, and only the fifth mast has a trysail.

Finally, there is a *full-rigged ship*, which must have not fewer than three masts, and has sometimes four masts. Only a few full-rigged ships with five masts have been built. All the masts on the full-rigged ship have yards and yardsails, and the mast nearest the stern has a trysail as well. A full-rigged ship with three masts is illustrated in picture 14. In spite of the fact that steamships are quicker, the sailing vessel has not yet disappeared from the seas.



14. A Full-rigged Ship.

ICES MADE WITHOUT A FREEZER

IN hot summer weather few things are more cooling and refreshing than ices. They cost but little, and can be quite well made at home. If we all knew how easily a delicious ice could be made without an elaborate freezer, we should more often want to make one. Let us see what we can contrive, even if we have no freezer.

First, we shall want a round can with a lid that shuts down tight. A coffee or syrup can would do. Then we want a large square tin cracker box, or a wooden pail. This is to hold the freezing mixture, with the syrup or coffee can in which we are going to make our ices in the middle of it. Before doing so we must see how and why the ice is formed inside the smaller can.

We know that water freezes below a certain temperature, but if we chop up a little ice and pour on it a little water and sprinkle it with coarse salt, we get a very low degree of cold indeed, because the salt acts on the ice and increases its power to freeze. So any liquid will freeze when buried in the freezing mixture, if left there long enough. It would turn into a block of ice if it were not hindered from doing so. How can we prevent it? The liquid will freeze first around the inside of the can, and to stop that we must stir it and scrape the can just as, but for a different reason, we stir the milk in a saucepan.

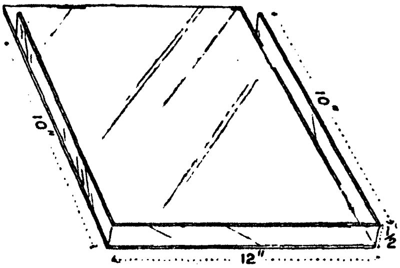
The box or pail has a layer of chopped ice and salt placed at the bottom; the can is placed on that, and ice and salt are piled around it up to the brim. The ice should be just double the weight of the salt. The mixture for the ice is placed in the can, the lid put on, and a blanket wrapped round the outside of the whole. It is then allowed to stand for some time. Removing the lid, we take our wooden stirrer, and scrape it round and round the inside of the can, to prevent the mixture from freezing solid; and then we replace the lid. We must be careful not to let the salt and ice get into the can, or our ice-cream will be spoiled.

And now what kind of ice shall we make? We can choose a water ice, made with water, or an ice-cream, made with cream. An ice-cream is nicer, but costs more. We may like to make both kinds, or custard can form a substitute for the cream, and fresh fruit or jam can be added.

Water ices can be made by mixing some syrup—sugar boiled in water in the proportion of one pound to one pint—with a fruit-juice from pressed strawberries or raspberries. There should be about twice as much syrup as fruit-juice. An ice-cream without cream is made from a custard in which are a tablespoonful of condensed milk, half a pint of milk, the yolks of two eggs, and sugar. This may be flavored with vanilla or essence of almonds, and put into the freezer. Or we can take half a pint of the custard, add to it a quarter of a pound of jam, and if this contains seeds, rub it through a sieve, and then freeze it. Coloring paste will make the ice a deeper red.

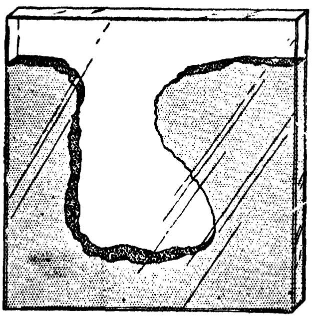
HOW TO KEEP ANTS AS PETS

THE habits of ants are so interesting that men of science have spent a great part of their lives studying them and their habits. We read something about these wonderful little creatures in that part of this book that begins on page 2965, but we may ourselves keep ants as pets in our drawing-room, and very interesting they are. The glass case in which ants are kept in the house is called a *formicarium*, a word that is made up from *formica*, the Latin or scientific name for the ant. Formicariums may be bought all ready and complete at some shops, but it is much more interesting to make our own, and as it is easy to do this, we will first of all see what is needed.



How the glass case is built up.

We must get two sheets of glass, say, twelve inches square, two strips of glass twelve inches long and half an inch wide, and two strips ten inches long and half an inch wide. These may be bought at any glazier's, cut to the sizes named, for a few cents, and ordinary window-glass will do very well. Now we must take one of the squares, and fasten the two ten-inch strips and one of the twelve-inch strips round the sides, flush with the edges, as shown in the first picture. Either glue or paste may be used for this purpose. Then, when the strips are dry, we must stick the other sheet of glass on the top of them, so that we shall have a shallow box without a lid, and with the narrow sides not reaching quite to the top of the wider sides of the case.


The formicarium ready for the ants.

The formicarium is all ready to receive the earth from which the ants are to form their nest or camp. The very best mould for this purpose is, of course, that to be obtained from an ant-hill, and this we can get in almost any garden or field in town or country. The earth may be put into the glass case by pouring it in at the top through a paper funnel, made in the same way that a grocer's sugar-bag is made. Sufficient earth is needed to half fill, or a little more than half fill, the formicarium, and a vacant space should be left in the centre with passages to the openings above the ten-inch strips. The top, which consists of the remaining twelve-inch strip of glass, is then put on the top, and glued or pasted in place. We now have our formicarium all ready for the ants, with two doorways or openings, one on each side, and the appearance of the case is as shown in picture No. 2.

We have next to catch our ants. Any kind will do, and we shall probably find what we want in our garden. We must dig down deep into the encampment to find the queen, who can easily be distinguished by her large size. The pictures on page 2969 of this book will perhaps help us. A bottle is a very good thing in which to carry the ants from the garden to the room where we are making our formicarium. Having put the queen in the bottle, we can place with her about fifty worker ants.

The next task is to get these into the glass case. We must close up one of the little doors with rag or wadding. Then, if we take a tea-tray and fill it with water, and stand a dish in the tray and then lay the formicarium on the dish, the ants' new home will be cut off by water from everywhere. We cover the glass case with a newspaper folded up, and lay our bottle on the paper with the cork out. The ants soon swarm out and all over the paper, but we guide the queen ant towards the opening of the formicarium and get her in, when the worker ants will all follow, and that very soon. As soon as they are in, we should plug up the doorway with a piece of wadding, and our formicarium is complete. We may, of course, ornament it in any way we like, but this is a matter of taste. The ants will soon get to work, and for hours we may watch them making their homes and performing their various duties without any fear of our getting tired, for there is no more absorbing recreation than watching an ant city being built.

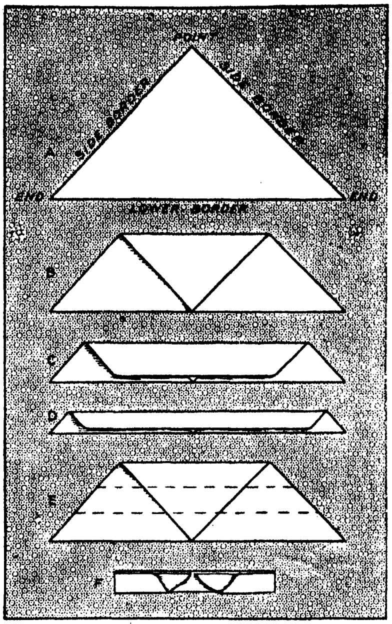
The formicarium should be kept in a shady place, and when not being watched a cloth may be thrown over it. It must never stand in the sun, and it is better to examine the ants by artificial light, as the little creatures do not mind this at all, whereas they do not like daylight, and will soon get out of sight if exposed to it. The earth should be kept moist by squirting a very little water into the case from time to time with a small syringe or a fountain-pen filler. The only food needed by the ants is a little honey placed inside the opening every day or two. A few of the little white creatures that ants make pets of, should be put in the nest, as they act as scavengers, and keep the ant city clean.

Thus completed, we have one of the most wonderful things that can be seen. The ants will make tunnels and corridors and lanes and rooms, and nurseries for their young ones, with front doors and side doors; and all the different kinds of ants will do their different kinds of work right before our eyes. As they have not the chance to get at another nest of ants, they will do no fighting, which is the least nice of all the habits in which the ants are so like men.

GIVING FIRST AID TO THE INJURED

WHAT TO DO UNTIL THE DOCTOR COMES

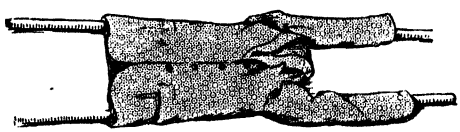
SOME time ago, in a busy New York street, a man met with a serious accident, and was in danger of bleeding to death. But a boy stepped from the crowd that had gathered round, and making a bandage and pad from a stone and a handkerchief, he tied these on the wounded man in such a way that the bleeding was stopped, and a doctor was able to reach the man in time to save his life.



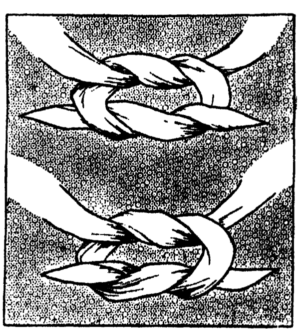
How to fold a triangular bandage.

Now, this was a splendid thing for a boy to do, and it is a thing that every boy and girl who reads this book may do also if necessity arises. The boy who saved the man's life in a New York street had been through a course of study for rendering first aid to the injured; and in these lessons we are going to learn what to do in case of accidents of all kinds—fractures or broken bones, hæmorrhage or bleeding, sprains, burns, scalds, bruises, drowning, poisoning, and so on.

We must distinctly understand that first aid is not intended to take the place of the doctor's work, and in all cases of serious accident we should call a doctor to the patient as soon as possible. But while someone has gone for the medical man, it is important that the very best should be done for the patient. If he has broken his leg, the broken bone must not be allowed to do any further injury; if he has cut himself, the bleeding must be stopped at once; and in all cases the patient must be placed in such a position that he will suffer as little pain as possible. And it is to help every boy and girl to know how to do these things that these lessons on First Aid to the Injured are being given.


A stretcher made from a coat and two poles.

But we must not look upon them as lessons, but as something that will always be useful to us. We shall find a great deal that is very interesting, and when we come to bandaging we can learn to become quite skilful at it by tying up one another for practice. If we are going to be successful and useful in this most valuable study—and surely we all want to be first-rate at everything—there are a number of points that we must remember at the outset.


Granny knot and reef knot.

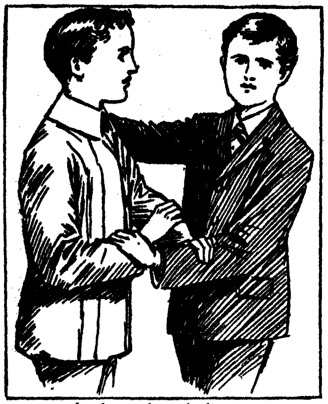
For instance we must be ever on the alert, so as to be ready to render help immediately an accident occurs; we must be full of resource, so that we can make use of whatever may be at hand, even though proper bandages and splints and stretchers are not available—just as the boy used his handkerchief and a stone from the road for a bandage and pad. Then we must be observant so as to notice all the circumstances of an accident, and in case of several injuries we must decide without any hesitation which of them should have attention first.

It is important that an injured person should have plenty of air, and if breathing seems to have stopped we must take steps to restore it. Then we must always see that any injured part is carefully supported, and the warmth of the patient should be maintained by placing a cloak or coat round him, especially if the weather is cold.

For broken arms and legs, splints are needed—that is, something solid and firm to which the arm or leg may be bound, so that the parts above and below the fracture may not move independently of one another, and still further increase the injury. For this purpose all kinds of things are useful—walking-sticks, umbrellas, baseball-bats, broom-handles, pieces of wood, and so on; and, before being applied, these should be padded with a coat, or some handkerchiefs, or sacking—anything soft, in fact in order to prevent any jolting. We shall learn later on how to apply a splint.

We now come to bandages. Bandaging is of the greatest importance in all cases of injury, and when no proper bandages are available we can make them out of

handkerchiefs, neckties, belts, and so on. Proper bandages, however, are very often close at hand, as in the case of accidents on the football field, for many players carry a bandage with them, and we must learn how to fold and tie these.


A three-handed seat.

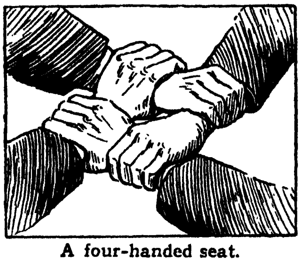
The most useful kind of bandage is the triangular bandage, shown in the picture. Two such bandages are made out of a square yard of calico by cutting diagonally across—that is, from corner to corner. This gives us two triangles of the shape shown in the picture, and each side and angle of the bandage have a special name. From this triangle we can fold a broad or a narrow bandage. We first fold the point to the lower border, as in B, and then for a broad bandage we fold over once again, as at C, and for a narrow bandage still once again, as at D. For a medium bandage we make two folds, as at E, after folding the point to the lower border. When not in use we fold as a narrow bandage and turn the ends in as in F. We shall learn later how this bandage is used for different injuries, but it is necessary for us to know how to tie the bandage when it is on. The granny knot is quite useless because it so easily comes undone. We must always tie a reef knot, shown in the lower picture, so that the bandage may not come undone; a little practice will make this quite easy.

In addition to triangular bandages, there are roller bandages, which are strips of linen, calico, muslin, of different widths and lengths; but for first-aid work the triangular bandage is much simpler to use, and besides, the strips of material would be rarely available in an emergency.

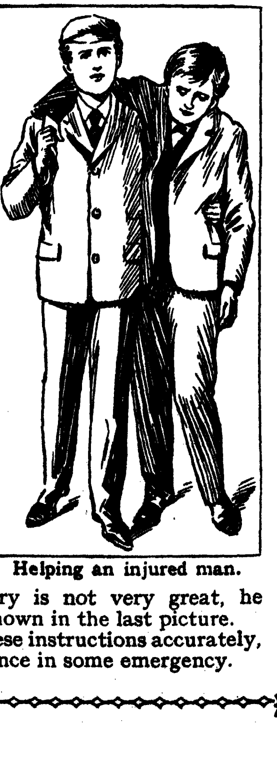
When anyone meets with an accident it is often necessary to remove some of his clothes, such as a coat or boot and stocking. This has to be done very carefully, and there is a regular method to be followed. In removing a coat we take it off the uninjured side first, and then, if necessary, cut the stitches of the seam in the sleeve, and lift the coat away. A shoe should be unbuttoned or unlaced, and the back seam cut open carefully. Stockings or socks can be cut off an injured foot with scissors or penknife. In burns and scalds the clothing must never be dragged from the injury, but any part adhering should be cut round and left for a doctor to attend to.

In lifting and carrying an injured person the greatest care must be exercised, and in serious cases, such as those of injuries to the back, it is better to wait for a doctor's arrival. In other cases, where bones have been broken, the utmost care is needed to prevent the ends of the fractured bone from causing still further injury.

For stretchers we can use hurdles, shutters, or planks, but if we use shutters or planks we must be sure to carry them slung in ropes or straps, in order to save jarring the injured person, and we should place coats upon them to make them soft and comfortable. When nothing of this kind is available, we can make a stretcher by buttoning up a coat and slipping poles through the sleeves and along the sides of the coat, as shown in the picture. If a larger stretcher is wanted, two coats may be arranged in this way on the same two poles. Sacks may also be stretched on poles by passing the poles through holes in the bottom corners. Of course, every stretcher should be tested before using.


A four-handed seat.

In lifting a patient on to a stretcher there must be gentle, steady effort without any jarring, and if an arm or leg is injured some helpers must support the wounded limb. The head should also be supported. The stretcher should be carried quite horizontally, and the bearers should, as far as possible, be of the same height. They should march with a short step, and bend the knees as they march. Where no stretcher is available we must make a seat for the patient with our arms. For what is known as a two-handed seat two bearers face each other and stoop down, one on each side of the patient. They each place one arm under his back just below his shoulders, and the other arms are passed under his legs, the hands being clasped. The way to make a three-handed seat, with a rest for the patient's back, and also a four-handed seat, with which another helper must support the patient's back and head, is shown in the pictures. If there is only one helper for an injured man, and the injury is not very great, he may be assisted as shown in the last picture.


Helping an injured man.

If we remember these instructions accurately, we may be of assistance in some emergency.

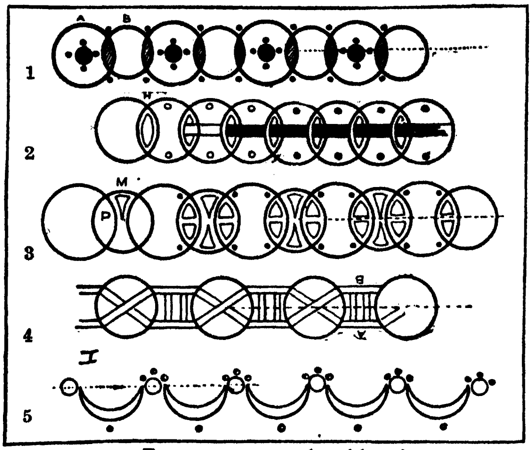
SIMPLE WAYS OF MAKING DESIGNS

WHETHER we are girls and are fond of needlework, embroidery, or china painting, or whether we are boys and do wood-carving, modeling, painting with stain on wood, or stenciling, we shall find the constant need of a pattern. Here we shall see how simple it is to make our own designs, which are very much more interesting to work upon than any we can buy.

We are only going to use ordinary, everyday things to help us to make our patterns—three coins to make circles, a quarter, nickel, and a ten-cent piece, also a rule and a piece of lead pencil.

First let us look at picture 1. This pattern is made with a ten-cent piece and a nickel.

To begin with, we must be sure that our pencil has a sharp, long point.



1-5. Easy patterns made with coins.

We first rule a straight line very faintly. This line is to be a guide only, and not part of the pattern. It is shown as a dotted line in the pictures. Now we take a nickel and place it on the paper over the guiding line, a ten-cent piece on each side, of the line. We should hold it with one finger firmly in position, and with the pencil mark round the edge; remove the coin and we shall find an even circle. In the picture this circle is marked A.

The next circle, B, is made with a ten-cent piece, and it overlaps A by one-eighth of an inch. This distance must be marked off on the guiding line with a ruler, before putting the ten-cent piece in position. To do this we must make a little dot on the guiding line one-eighth of an inch away from the edge of the circle—where it crosses the line—and, of course, it must be *inside* the circle.

This dot shows us how far to *overlap* the ten-cent piece when we place it on the line. We must do this each time we have drawn a circle, using the same distance—that is, one-eighth of an inch exactly.

We continue to use these two coins alternately until we have made as long a line of circles as we want. The rest is very simple, because anyone can make dots. We must make fairly big ones outside the circles where they cross, and very big ones in the centres of the big circles. The guiding line helps us to see where the big dots are to be placed, and also to place the two dots on either side. We can guess the other two dots—they come top and bottom—and make up our dots round the big dots. If we color in the little shapes formed by the circles overlapping, the design is complete.

Now let us look at picture 3. For this pattern we take a quarter and a nickel, and use them in just the same way as in pattern 1, but with this difference—that the overlap is much bigger. In each case it is three-eighths of an inch, marked P in the picture.

The next thing to put in is really easier than it looks, because it is done "freehand." We must carefully follow the outline of the space marked M, making it a little smaller, with the point of this little shape just touching the guide-line. The other shapes in the picture are filled in in the same way. Then the dots are added—but we must be careful not to make them too small.

Picture 2 shows our next pattern, which is made with a nickel only, and the overlap distance is a quarter of an inch. The spaces formed by the overlap are filled with smaller spaces, outlined in pencil, just as the last pattern was done; then a line is ruled along *each side* of the guide-line, a very short distance away, and made to look as though it threaded itself in and out of the circles by rubbing out with india-rubber the part supposed to be behind. The dots are put in last. Pictures 4 and 5 show two more patterns, both being made with a nickel, much in the same way as the previous ones. For number 4 we must make the circles three-eighths of an inch *apart*, measuring the distance as usual along the guiding line, then drawing the two lines A and B level with each side of the guiding line, and a quarter of an inch away from it. Next we add the connecting bars, two between each circle, and finally join up the outside lines *across* the circles, drawing them so that one seems to go underneath the other.

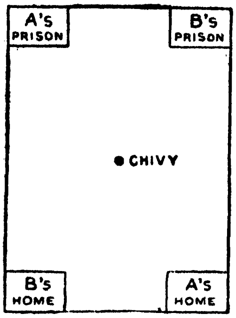

A design for a sideboard cloth.

The half-moon in picture 5 is made by marking only *half*-way round the nickel and then shifting it up a little—about one-eighth of an inch—and marking another half-circle, joining the first one at the points of the moon.

OUTDOOR GAMES FOR BOYS

PRISONERS' BASE

THE playground, or part of it, should have four spaces marked off—one in each corner, as seen in the picture. The distance between the prisoners and homes should be not less than twenty yards. The players divide themselves into two parties, A and B, each party selecting a captain. They then go to their separate homes, and one of the captains sends out "a man" to the place marked in the centre, where he calls the words, "Chivy, chivy!" Out darts one of the enemy to capture him before he can reach home again. But this pursuer has hardly started when one of "Chivy's" friends rushes out to catch the pursuer. Thus one after another all the players leave home, but no one must on any account try to touch any boy except the one he left home to follow. Above all, each should not forget that while he is seeking to capture the enemy, another of the enemy is seeking to catch *him*. This makes matters exciting. A prisoner is made by simply touching a boy; and once this is done the toucher is safe until he has taken his captive to gaol. He may then walk "home" and wait to be ordered out again by his captain. Prisoners are released by one of their own side touching them as he runs by the prison; and if there are many inside, they may join hands and stretch out to meet their friends, so long as the last in the line keeps one foot in gaol. The side that succeeds in making all the others prisoners wins the game, but it has to be a very clever captain who can direct his men so as to manage to do this.



FLY THE GARTER

TO start with, all the players make a running jump, and the one whose jump is shortest has to "give a back" for the others. A chalk line, called the garter, is drawn, and standing close beside this he bends his back and tucks in his head. When the others have gone over him as in leap-frog, he is told to "foot it"—that is, move away from the line the length of his own foot, and bend down again. This time, in going over, each player must start his jump from the "garter," and if all succeed in doing this, the "back" moves on another foot for the next turn. By and by the distance from the garter becomes too great for one of the jumpers; and the first to make a false leap must take the place of the "back," who then joins the others.

FOX IN THE HOLE

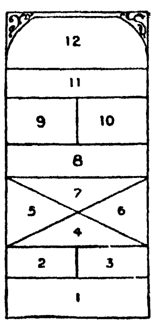
THE "fox" stands on a piece of ground marked off for him to live in. He is allowed to carry a knotted handkerchief for self-defence. When the hunters come to attack, he hops out to meet them on one foot. During the battle that follows he must not put his second foot to the ground, or, if he does, he will be basted home again without the right to hit back. If, however, he touches one of the enemy with his knot while hopping, the one so touched is basted by the rest into his home and becomes fox in his stead. While in his home the fox is quite safe from attack.

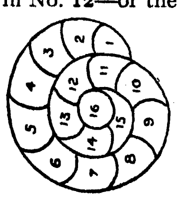
PEE KU

HALF the number of players join hands in a circle, forming what is called a fortress, which the other half seek to take by forcing their way into the middle. The defenders must not loose each other's hands, but may raise them or lower them to stop the attackers getting over or under. They may spread themselves out or draw together in a closer circle when danger is near, and they may change their positions to stop anyone crawling between their legs. If an enemy gets through, he may assist his friends who are trying to follow him, and when half the number are within the fortress, it must "haul down its flag and surrender" to the victorious party.

HOP-SCOTCH

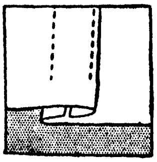
THE game of hop-scotch is played in different ways, but the way which we shall see here is the usual one. We first draw on the pavement of the playground with chalk a plan like this. The larger divisions are about two feet wide. The first player then stands at a short distance and pitches a flat stone or piece of shell into No. 1. If it settles properly in the space, he hops after it and kicks it out again without putting his other foot to the ground. Returning to the starting place, the shell is again tossed, this time into No. 2, and the player hopping after, kicks it out once more, but through No. 1. This action is repeated through every division up to 12, unless the shell settles on a line or is pitched into the wrong division. In either event the player stops and the next player takes his turn. Though only hopping is allowed, any player who gets as far as division 8 may rest by putting one foot in No. 5 and one in number 6, but must go on hopping when he turns to kick the shell out again. On each return journey he may hop and kick as often as he likes, except when the shell has been tossed in No. 12—or the cat's head, as it is sometimes called. *That* time he must kick it out at one kick right through all the divisions. But if he does so, he has won a game, and his hopping labors are over. In French hop the plan on the pavement is drawn like this. The shell is placed in No. 1, and the hoppers kick it through each division till No. 16 is reached. After a short rest it is kicked back the reverse way to No. 1 and out.





A BATHING-SUIT A GIRL CAN MAKE

A COSTUME suitable for sea-bathing for a girl who does not swim needs to be of a different pattern from one to be worn by a swimmer, when there should be no short skirt to cling round the legs and hamper the movements when swimming; but, on the other hand, a tightly clinging combination suit does not look well for sea-bathing, unless, perhaps, for very little girls. Many people bathe from their own tents and bathing-houses, and have a stretch of sand to run over before reaching the water, so that some kind of tunic skirt is necessary.



1. Seaming.

In the costume shown in picture 2, both these purposes are served. The upper part and the bloomers are *cut in one piece*, and the little tunic skirt is cut separately, and fastened on by buttons and buttonholes. For the material, we should choose a double-width one of serge or Oxford shirting, both wash well and are durable. The shirting has the advantage of being not only washable, but strong and soft; it may be had in a plain blue or striped pattern. Serge in several colors is suitable, and looks well trimmed with a fancy braid. We will make our costume of dark blue serge, and trim it with a white fancy braid. Enough braid will be required to edge the skirt, bloomers, sleeves and neck, as well as to form a belt.

The quantity of the serge depends, of course, on the size of the figure, and a near estimate of it can be made from the shape of the under-garment a girl usually wears, allowing for a very loose fit. Indeed, this may be taken as a correct guide for making the costume. The material is folded lengthways—so that the selvedges run down the length of the garment—the fold coming where the shoulders are, marked A A in the picture. A square neck is then cut out of the centre of the fold; if a high neck is preferred, it can easily be sloped in a curve in front and back.

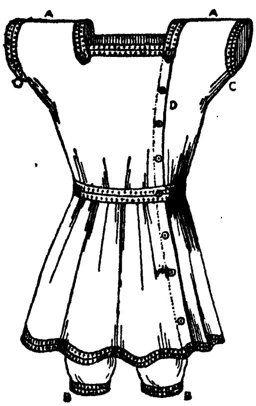
To form the short sleeves, the material is cut the required length and curved in under the hollow of the arms, and thence to the waist-line, brought out again slightly below it, and taken in again down to the knees. The bloomers part, which is not shown in the picture, does not fasten anywhere, there being plenty of room to slip in and out of the suit through the opening—marked D—at the left side of the front, which is slit down to the waist-line.

To finish off this opening, a false hem is put on to the right side of the slit and double-stitched across at the bottom to make it firm. Through this broad hem five buttonholes are worked. The way to put on a false hem is explained on page 848. A narrow hem is made along the edge to the left of the opening, and white bone buttons are sewn along the right side of it. The hem is made firm to hold the buttons by laying a strip of black tape along the back, and hemming it on in such a way that the stitches do not show on the right side.

And now for the joining up of the sides. From the sleeves to the knees, from C to B, the garment is seamed, and also where the bloomers are cut up to form the legs. Seaming is done by a sewing-machine in this way. Turnings are made at the two edges of the material; these are placed together, as shown in picture 1, and machine-stitched near to the turned edges along both sides. If it is inconvenient to machine-stitch the seams, they can be run and felled. The seam inside the two halves of the bloomers is worked in the same way. The extra fulness at the waist is held in by the band shown in the picture.

The neck is edged back and front with straps of double braid, and two other straps, pointed at the ends, pass over the shoulders and are sewn down with buttons over the ends of the other two. Braid is put round the short sleeves and the bottom of the bloomers.

A double row of braid forms the waistband, which can be strengthened by a piece of the serge at the back, and is then stitched along *its upper edge* for an inch or two to the middle of the waist-line at the back to hold it in position. The waistband is fastened by a button and buttonhole, as seen in the drawing. The skirt is very simply made, for it is cut in a strip, sufficiently long to make the fulness suitable for the figure, and gathered into a narrow waistband of the serge, in which a few buttonholes are made. Hems, one broad and one narrow, are made at the ends. Three buttonholes are worked in the broad one, and corresponding buttons are sewn on to the narrow one to continue the line at D. Buttons to correspond should be sewn on to the under-garment, just under the waistband, so that they are hidden when the skirt is not worn. Braid is sewn round the bottom of it in two rows.



2. The costume complete.

It should be remembered that some kinds of material shrink more than others, and that sea-water is disastrous to certain colors. It would not do to make the costume and then find it shrink; therefore, ample room should be left for movements of the body, especially when stretching full length, as one must do when swimming.

If the girl who is making this bathing-suit understands anything about dressmaking, she will know that if the material at the shoulder-line, marked A in picture 2, is slit, and sloped slightly down towards the arms, the gown will look more shapely than if it were left quite straight. One hardly expects a bathing-suit to fit well like a dress, of course, but, if we do not mind a little extra work, we shall find the little seams suggested a very great improvement indeed.

A LITTLE VEGETABLE GARDEN

WHAT TO DO IN THE MIDDLE OF AUGUST

ANOTHER seed-sowing season has come round again; indeed, as we have seen, there are few months from early spring to late autumn when we may not sow one thing or another. In August the most important crop to think about is the onion. The onions that were sown in the spring, and have been growing all through the summer, are by this time almost ready to lift and dry—much depends, of course, on the district and the date at which they were sown—for winter use. We can even use them for some time in the spring. Then the time comes when, of their own accord, they begin to sprout, and sometimes even to produce fresh roots; then, of course, they are of no more use for cooking. The seeds that we sow in the month of August are intended to produce a crop to follow these winter onions. We should choose a position that gets as much of the winter sunshine as possible, and the kind of onion to sow at this time is the Tripoli.

Another crop, the seed of which we may sow now, is the winter spinach; very often it is sown on the ground that has been occupied by the potatoes. It is important to sow thinly, and when the seedlings are well up, it is necessary to thin out the little plants until they stand six inches apart in the rows.

During this month many people also sow a row or two of turnips, so as to have young roots for use during the winter; but in small gardens we cannot grow everything, so we must make our choice, and decide which will be most acceptable in the kitchen.

But still we have not come to the end of the vegetable seeds we might sow, and mention may well be made of lettuces. The kind to select is known as the brown cos lettuce, as this is the most likely to stand the severity of the winter. It is never a very certain crop, and some people take the precaution of putting a cold frame over the plants when the sharp weather sets in. Others, again, let them take their chance, and more often than not, when the soil is not unusually heavy and cold, most of the plants are strong and healthy in the spring, and may then be planted out. These, of course, are a considerably earlier crop than those not sown until the spring.

If we are thinking of planting a strawberry bed, the soil must be made ready. We must dig it deep and put in some well-rotted manure, and after that it is as well to tread it. Half the secret of getting the plants to take quickly to the soil is to plant them firmly.

If the out-of-door tomatoes are ripening quickly now, we may pick those that are ruddy, and finish ripening them in a sunny window, or, better still, in a greenhouse or conservatory, as near to the glass as we can get them. Of course, they must be partially colored before we pick them. We must still keep a look-out for side growths, and remove them as soon as they appear. If the plants are bearing fruit very plentifully, it is well to feed with liquid manure well diluted with water. We need not give this every day, but only alternately with plain water.

Perhaps the patty-pan squashes are now showing fine large fruits, and we must remember that there is no need to let these remain on the plants after they have reached a fair size, as the plants will be all the better without them. Young immature squashes, freshly picked, are a great deal nicer to eat than those that have fully matured their seeds.

A FLORAL BAROMETER

ON another page we read how to make artificial flowers. We can turn the art to account in a practical fashion, and make a bouquet of paper flowers that will tell us what the weather is going to be. So let us make some flowers out of pink paper, and some others out of blue paper. Any kind of flowers will do, so long as we use these two colors. We can make either a big or a small bouquet.

Now we purchase from a druggist a few cents' worth of chloride of cobalt, and dissolve it in water. When it is dissolved, we dip the flowers into the solution we have made, then hang them up to dry. If the solution is weak, we may dip them in a few times, letting them dry before every repetition of the bath. That is all we need. The floral barometer is ready for its work. When the weather is going to be damp, the flowers made of pink paper will remain pink; but when it is going to be dry, they will change into a purple color. Also, the flowers made from blue paper will remain blue when the weather is going to be wet, but when it is going to be dry they will turn to green. This floral barometer is fairly reliable, and is more reliable than many expensive instruments to foretell the weather.

The paper bouquet, when coated with the solution of chloride of cobalt, as we have described, becomes what is called by scientific men a *hygrometer*, which means measurer of moisture, and which comes from two Greek words—*hygros*, moist; and *metros*, a measure. A bit of seaweed fresh from the sea forms a very good hygrometer. This is crisp and dry in warm weather, and moist and clammy in wet weather. This is caused by the salt that remains on it; the salt takes in moisture from the air when the air is moist, and, when the air is dry, so is the seaweed and the salt. If our senses were keen enough we could tell when the air is moist or dry, but our senses are not nearly keen enough to detect little changes, and careful students of chemistry and of Nature have found out that the effect upon other objects, such as salt seaweed, is much greater than it is upon men and women and boys and girls, so that by studying seaweed and other things we can tell what changes the air is undergoing, and so can tell what kind of weather we are going to have.

THE NEXT THINGS TO MAKE AND THINGS TO DO ARE ON PAGE 4039.

A FAMOUS STORY OF A GOOD MAN

It is over half a century since "John Halifax, Gentleman" was written, and, as it is still one of the most widely read of English stories, it certainly deserves to be included among the famous books written by English authors. Not that it is in every way a great story, for it is remarkably lacking in incident and movement. It depends entirely for its interest on the character of its hero, who is, in every sense, an example of true manliness, a Christian gentleman. The fact that its author can interest us in her hero with so quiet a story is all the more to her credit. "John Halifax, Gentleman" was written and published in 1857 by a lady named Dinah Maria Mulock, who was then thirty-one years of age, and who had earlier written several stories. Some years later she married a gentleman named Craik, and sometimes her married name is given on the title-page of this, the most famous of her books. Mrs. Craik died on October 12, 1887.

JOHN HALIFAX, GENTLEMAN

CONTINUED FROM 3839

"GET out o' Mr. Fletcher's road, you idle, lounging, little——"

"Vagabond" was no doubt what Sally Watkins, the old nurse of Phineas Fletcher, was going to say, but she had changed her mind in looking again at the lad, who, ragged, muddy, and miserable as he was, was yet anything but a "vagabond."

A downpour of rain had drawn Mr. Fletcher and his son Phineas to shelter in the covered alley that led to Sally's house, on their way home. Mr. Fletcher pushed the little hand-carriage in which his weak and ailing son was seated into the alley. The ragged boy, who had also been sheltering there, lent a hand in bringing Phineas out of the rain, Mr. Fletcher saying to him kindly, after Sally's outburst, "Thee need not go into the wet, my lad. Keep close to the wall, and there will be shelter enough both for us and thee."

Mr. Fletcher was a Quaker, as will be seen from his form of speech and his consideration for the poor boy. He was a wealthy tanner in the town of Norton Bury, and in every sense a good man, who, though prosperous in business, had suffered sorrow in his life. His wife had died, leaving him with their only child, Phineas, now a sickly boy of sixteen.

The ragged lad, who had seemed very grateful for the Quaker's kind words to him, stood leaning idly against the wall, looking at the rain that splashed on the pavement of the High Street. He was a boy of perhaps fourteen years; but, despite his serious and haggard face, he was tall and strongly built, with muscular limbs and square, broad shoulders, so that he looked a lad of seventeen or more. The puny boy in the hand-carriage, the child of a wealthy man, who had had all the care that money could secure, was filled with admiration for the manly bearing of the poor lad; for, in common with all people who are not physically strong, he admired a youth of manly appearance.

After some time the rain gave promise of ceasing, and Mr. Fletcher, pulling out his great silver watch, which had never been known to be wrong, said:

"Twenty-three minutes lost by this shower. Phineas, my son, how am I to get thee home? Unless thee wilt go with me to the tanyard——"

The boy in the hand-carriage shook his head, and his father then called out to Sally Watkins if she knew of anyone who would wheel him home. At the moment old Sally did not hear, and the ragged boy mustered courage to speak for the first time.

"Sir, I want work; may I earn a penny?" he said, taking off his

tattered old cap and looking straight into Mr. Fletcher's face. The old man scanned the honest face of the lad very closely.

"What is thy name, lad?"

"John Halifax."

"Where dost thee come from?"

"Cornwall."

"Hast thee any parents living?"

The lad replied that he had not, and to many other questions with which Mr. Fletcher plied him he returned straightforward answers. The tanner promised him a groat if he would see Phineas safely home when the rain had ceased, and asked him if he would care to take the piece of silver now.

THE LITTLE GIRL WHO CUT A SLICE OF BREAD FOR POOR JOHN HALIFAX

"Not till I've earned it, sir," said the Cornish lad. So Mr. Fletcher slipped the money into his son's hand and left them. Only a few words were spoken between the two boys for a little while after he went away, and John Halifax stood idly looking across the narrow street at the mayor's house, with its steps and porticoes and its fourteen windows, one of which was open, showing a cluster of little heads within. The mayor's children seemed to be amused, watching the shivering shelterers in the alley; but presently a somewhat older child appeared among them, and then went away from the window quickly. Soon afterwards the front door was partly opened by someone whom another was endeavoring to restrain, as the boys on the other side of the street could hear loud words from behind the door.

"I will! I say I will——"

"You sha'n't, Miss Ursula!"

"But I will!" And there stood the little girl, a loaf of bread in one hand, and in the other a carving-knife with which she succeeded in cutting a large slice from the loaf.

"Take it, poor boy! You look so hungry," she said. "Do take it!" But the door was shut again upon a sharp cry of pain; the headstrong little girl had cut her wrist with the knife.

THE BEGINNING OF GOOD FORTUNE AND HAPPINESS FOR THE WANDERING BOY

After a little, John Halifax, who was clearly famished for want of food, went across the street and picked up the slice of bread which had fallen on the door-step. In those days poor folk rarely tasted wheaten bread at all, and probably the Cornish lad had not eaten a morsel of it for months. He now ate the slice very slowly, and looked very thoughtful all the while. This was the beginning of all that made for happiness and good fortune in the life of John Halifax, as we shall discover in due time.

From the moment Phineas had set eyes on him he liked the lad. The invalid boy lived a very lonely life, with no playfellows and no friends of his own age, and he longed to make a friend of this strong-looking, honest youth who had so suddenly come into his life. John was so tender in the way he helped Phineas home that the Quaker boy felt sure he would be a worthy friend.

It appeared that John had heard of his father as a sad, solemn sort of man, much given to reading. He had been described to John as "a scholar and a gentleman," and the lad had determined that he, too, would be a scholar and a gentleman. He was only an infant when his father died, and his mother, who had been left very poor, had a sore struggle until she died, when John was only eleven years old. Since then the lonely boy had been wandering about the country getting odd work to do at farms, and at other times almost starving.

JOHN HALIFAX DETERMINES TO BE A GENTLEMAN LIKE HIS FATHER

Thus he had wandered to Norton Bury; and now, thanks to Phineas, Mr. Fletcher gave him a job at the tannery, although at first he was not altogether sure of John's character.

It was not long, however, before the two lads were fast friends, and spent much of their time together. John Halifax could read, but he had not yet learned to write; so Phineas, who had been well educated, became his friendly tutor, and repaid his devotion by teaching him all he knew.

One day John took from his pocket a little case of leather, with an inner one of black silk, which enclosed a book. This was the one treasure he had carried about with him since his mother's death; and he would not let it go out of his hand, but held it so that Phineas could see the leaves. It was a Greek Testament, on the fly-leaf of which was written, after the old English fashion:

"Guy Halifax, his book.

"Guy Halifax, gentleman. Married Muriel Joyce, spinster, May 17, in the year of our Lord 1779.

"John Halifax, their son, born June 18, 1780."

There was one more entry, in a feeble, illiterate hand:

"Guy Halifax, died January 4, 1781."

Giving Phineas a pen, but never once letting go of the precious book, John asked him to make another entry on the same page:

"Muriel Halifax, died January 1, 1791."

That was all Phineas ever heard of the boy's parentage, nor did John know more about it himself. He was indebted to no forefathers for a family history; his pedigree began and ended with his own honest name—John Halifax. But his father had been a gentleman, and he meant to be a gentleman too.

John Halifax did not like the work he had to do at the tannery, where his days were passed among dirty and evil-smelling things; but, none the less, he did his duties faithfully, and never shirked a task. At times the desire rose in him to go away and try to find some better occupation; but when he read "The Pilgrim's Progress" he saw that the path of duty was never easy to follow, and so he continued his labors in the tannery with a stout heart.

JOHN HALIFAX DOES HIS DUTY FAITHFULLY AND IS NOT WITHOUT REWARD

The result was that, as the years passed, and old Mr. Fletcher found him worthy of the highest trust, John became manager of the business, and went to live in the house of his employer. In knowledge, too, he had grown, for Phineas had been a good tutor, and John was so apt and studious that before long Phineas confessed that his pupil knew more than he.

One day when they were having an open-air lesson on a hill above the River Avon, they saw a boat in such distress that its occupants were in danger of drowning. John managed to effect their rescue; and one of them, Squire Brithwood, a haughty, conceited person, instead of thanking his rescuer, threw him a piece of money, which John threw back at him. The other, who seemed indignant at the way the squire had treated the boy, inquired of John who he was and what he did; but seemed disappointed on hearing that he was only a worker in Fletcher's tanyard.

"My name is March—Henry March," said the gentleman. "If you should ever——"

"Thank you, sir. Good-day!" was all that John would say, and so the matter ended.

Some years after this John and Phineas spent the summer days at the rural village of Enderley, where they lived at Rose Cottage. Enderley was not far from Norton Bury, and every day John rode there to look after the tannery and the flour-mill which had recently been added to Mr. Fletcher's now flourishing business.

HAPPY SUMMER DAYS AT ROSE COTTAGE IN THE COUNTRY

Now, Rose Cottage was really two houses, in one of which the young men lived, while an invalid gentleman and his daughter occupied the other. John Halifax had noted this young lady occasionally in his walks across the breezy downs which surrounded the place, and thought her the sweetest creature he had seen. When he learned that her name was Ursula, he was thrilled with happy memories of the little girl who had thrown him the slice of bread, for he had heard her called by that same name, and wondered if this might be she grown into a young woman.

Ere long he learned to know his pretty neighbor, and became her companion in their rural walks. No artist ever painted a more attractive picture than these two made as they walked briskly across the wind-swept uplands; she with her sparkling dark eyes, her great mass of brown curls escaping from her hood, and John with his frank, ruddy face, and his fine, swinging, manly figure.

WHY URSULA LEFT ROSE COTTAGE AND JOHN HALIFAX WAS SAD

Ursula's father, who had been ill when he went to the cottage, died suddenly, and was buried in Enderley churchyard. He was the same Henry March whose life John saved that day when the Avon was in flood. He was cousin to Squire Brithwood; and, unhappily, Ursula's fortune was left in the keeping of that haughty and unchristian person. The squire's wife, Lady Caroline, was a light-headed, senseless woman, as much talked about in Norton Bury for her foolish conduct as her husband was notorious

for his drunkenness. Yet it was to the care of such as these that Henry March had left his daughter, though he had intended to appoint another guardian to look after her.

John was very sad at the thought of Ursula leaving the cottage for the squire's home at Mythe House, for he knew that she had been happier there in the sweet country retreat than she would ever be in the ill-conducted household of her guardian. She, too, had regrets at the thought of going—John and she had become fast friends.

JOHN HALIFAX TELLS URSULA THAT HE IS ONLY A TANNER'S APPRENTICE

John told her that Mr. Brithwood would probably deny his right to be considered a friend of hers, and would not allow his claim to be thought a gentleman, even though a poor one. In answer to her expression of astonishment, he said:

" It is right, Miss March, that you should know who and what I am to whom you are giving the honor of your kindness. Perhaps you ought to have known before; but here at Enderley we seem to be equals—friends."

" I have indeed felt it so."

" Then you will the sooner pardon my not telling you—what you never asked, and I was only too ready to forget—that we are *not* equals—that is, society would not regard us as such, and I doubt if even you yourself would wish us to be friends."

" Why not ? "

" Because you are a gentlewoman, and I am a tradesman."

The news was evidently a shock to her. It could not but be, reared as she had been. She sat—the eyelashes dropping over her flushed cheeks—perfectly silent. John's voice grew firmer, prouder; there was no hesitation now.

THE LITTLE GIRL WHO GAVE JOHN HALIFAX BREAD WHEN HE WAS STARVING

" My calling is, as you will soon hear at Norton Bury, that of a tanner. I am apprentice to Abel Fletcher, Phineas's father."

" Mr. Fletcher ! " She looked up at him, with a mingled look of kindliness and pain.

" Ay, Phineas is a little less beneath your notice than I am. He is rich, and has been well educated; I have had to educate myself. I came to Norton Bury six years ago—a beggar-boy. No, not quite so bad as that, for I never begged. I either worked or starved."

The earnestness, the passion of his tone, made Miss March lift her eyes, but they fell again.

" Yes, Phineas found me starving in an alley. We stood in the rain opposite the mayor's house. A little girl—you know her, Miss March—came to the door and threw out to me a bit of bread."

Now indeed she started.

" You ! Was that you ? "

" It was I ! "

John paused, and his whole manner changed into softness as he resumed:

" I never forgot that little girl. Many a time, when I was inclined to do wrong, she kept me right—the remembrance of her sweet face and her kindness."

That face was pressed down against the sofa where she sat. Miss March was all but weeping.

John continued:

" I am glad to have met her again, and glad to have been able to do her some small good in return for the infinite good she once did me. I shall bid her farewell now, at once, and altogether."

A quick, involuntary turn of the hidden face seemed to ask him " Why ? "

THE ILLNESS OF JOHN HALIFAX AND A DREAM THAT CAME TRUE

" Because," John answered, " the world says we are not equals; and it would be neither for Miss March's honor nor mine did I try to force upon it the truth—which I may prove openly one day—that we *are* equals."

Miss March looked up at him—it were hard to say with what expression, of pleasure, of pride, or simple astonishment; perhaps a mingling of all; then her eyelids fell. She silently offered her hand, first to Phineas, and then to John. John pressed it, and rose. His hand was on the door, but he could not go.

" Miss March," he said, " perhaps I may never see you again—at least, never as now. Let me look once more at that wrist which was hurt."

Her left arm was hanging over the sofa, the scar being visible enough. John took the hand, and held it firmly.

" Poor little hand—blessed little hand ! May God bless it evermore ! "

Suddenly he pressed his lips to the place where the wound had been, a kiss long and close, such as only a lover's

SCENES FROM JOHN HALIFAX, GENTLEMAN

John Halifax and his sweetheart Ursula, having determined to be married, came to old Mr. Fletcher, who had been so good a friend to them, for his blessing.

Young Lord Ravenel, the son of the Earl of Luxmore, loved to sit and listen to Muriel, the beautiful blind daughter of John Halifax, playing on the organ.

One day a stranger came to the door, and for a moment was coldly received, until he told Maud that he was her brother Guy come back from America.

The end of John Halifax was as peaceful as his life. On the hillside, where he had been watching his young people, he fell into the sleep that knows no waking.

kiss could be. Surely she must have felt it—known it. A moment afterwards he was gone. That day Miss March departed, and John and Phineas remained at Enderley alone.

After John Halifax returned to Norton Bury he was seized with illness, and for a time it looked as if he might not recover. In his delirium he called aloud for Ursula, and dreamed that she had come to sit beside him and asked him to live for her sake. Phineas, in his anxiety for his friend, brought Ursula to him, and the dream came true, for she did ask him to live for her sake. He recovered at length, and became Mr. Fletcher's partner.

Going to London on behalf of the business, John there met the great statesman, Mr. Pitt, who was impressed with the natural abilities of the young man. His reputation for honesty and sound common-sense had now grown so great in Norton Bury, that when he returned there he found himself one of the most respected men in the town.

THE MARRIAGE OF JOHN AND URSULA AND THE FORTUNE DENIED THEM

Although he was still far from being rich, he was no longer a poor worker, and as Ursula was willing to share his life, they boldly determined to be married, in spite of her guardians, who asserted that John should never touch a penny of Ursula's fortune. They contrived, however, to be happy without it, for John refused to go to law to recover his wife's money, and was determined he would work honestly to support her. Lady Caroline would have been friends with them, but he wished to have nothing to do with her, or the class of people who were her associates.

With the death of old Mr. Fletcher, however, came misfortune, for it was found that the tannery was no longer a paying property, and there were only the mills to go on with. The temptation now was strong, in the face of his difficulties, for John to claim his wife's fortune, illegally held by Squire Brithwood. But he resisted it, and determined to struggle on.

At this time Ursula's relative, Lord Luxmore, who was anxious to see the Catholic Emancipation Bill passed, thought he could use John Halifax for his purpose by offering to have him returned to Parliament for the "rotten borough" of Kingswell, the member for which was then elected by only fifteen voters. Twelve of these were tenants of Lord Luxmore, and the other three of Phineas. But although John would have supported the Bill, he was too honest to permit himself to be elected to such a seat, as all honest men were then agitating to abolish these "rotten boroughs."

JOHN HALIFAX'S HONESTY IS PUT TO THE TEST AND FOUND TRUE

So he declined, and Luxmore next tried to win him over by offering him the lease of some important cloth-mills he owned; but these John would not take on credit, and he had no money to pay for them. So Ursula now determined to tell Lord Luxmore all about the way her fortune had been kept from them; and the result was that Lord Luxmore went to Brithwood and made him turn over the money to her. When John purchased the lease of the mills, Lord Luxmore thought he had secured him firmly, and that John would use his great and growing influence with the people of the district to further Luxmore's political schemes.

While all this was going on, young Lord Ravenel, the son and heir of Luxmore, had been a constant visitor at the Halifax home, and delighted in the company of John's daughter, Muriel. Halifax had now three children: two boys, named Guy and Edwin, and Muriel, who, alas! had been born blind. Perhaps on account of her infirmity she was the pet of her parents; but she was of a gentle and affectionate nature, and was also beautiful to look upon, even with her sightless eyes. Young Ravenel was also a gentle youth, and, like Muriel, was fond of music.

THE INDEPENDENCE OF JOHN HALIFAX AND HOW HE MET OPPOSITION

The time for the election of the member for Kingswell had now come round, and as Luxmore had failed to induce John Halifax to stand, he put up another person, who would do just as the earl wanted. But he was greatly mistaken in supposing that John would use his influence to make the handful of voters, most of whom were employed in his mills, vote for Luxmore's man. Instead of that, Halifax advized them to be honest, and vote as they thought right; with the result that Lord Lux-

more evicted them from their homes, as was often done in England before the reform of political voting. But John found new homes for them, and everything prospered with him.

As his riches increased, he bought a stately country mansion, named Beechwood, not far from Rose Cottage, which was ever dear in memory to him. Another son, Walter, was born to him, and everything seemed to smile on him in his beautiful country home.

DESPITE UNFRIENDLY OPPOSITION, JOHN HALIFAX GROWS IN PROSPERITY

Luxmore now sought to injure him by diverting the water from his cloth-mills, and leaving his great wheels idle. Of course, Halifax could have taken him to law; but, instead of that, he simply set up a steam-engine, which was then a great novelty; and his mills did better than ever.

Luxmore, finding it useless to fight against the resourceful Halifax, went abroad, and left his son, Lord Ravenel, alone at Luxmore Hall. The young man, despite his father's unfriendly conduct, was still a frequent visitor at Beechwood, and when poor Muriel died, his grief at her loss was only less than that of her parents.

The years passed by, and happiness still reigned at Beechwood; but little had been seen of Ravenel, until one day John Halifax met him, greatly changed from the gentle youth of the past, at Norton Bury. John invited him to ride over with him to Enderley.

"Enderley? How strange the word sounds! Yet I should like to see the place again," said Ravenel, who decided to accompany John Halifax and Phineas Fletcher in the drive back to Beechwood. It was a cold and bitter night in early winter, and Ravenel wrapped himself closely in his furs as they drove along the turnpike road.

THE ATTACK IN THE NIGHT, AND HOW JOHN HALIFAX ACTED

He inquired kindly for all the family, and was told that Guy and Walter were as tall as himself, while the daughter——

"Your daughter?" said his lordship, with a start. "Oh, yes; I recollect—Baby Maud. Is she at all like—like——"

"No," said John Halifax. Neither said more than this; but it seemed as if their hearts warmed to one another, knitted by the same tender remembrance.

At an unfrequented part of the road the carriage was set upon by a number of men, who, seizing the horses, shouted out that they wanted money. The times were hard, and these were some of the unemployed laborers of the countryside, who, in desperation and folly, thus sought to extort money from the wealthy John Halifax. But the master of Beechwood showed Lord Ravenel how firmness and gentleness could win the hearts even of one's enemies.

The horses, plunging and rearing in the darkness, knocked down one of the men, and while Ravenel would have had Halifax whip ahead at this moment, John, quieting the horses, leaped down to the ground, and lifted the man up with the assistance of some of his fellows. Examining his injuries by the light of the carriage lights, he found, to his sorrow, that he had been killed. The other men were so amazed by this act, and especially when Halifax had the dead man wrapped in one of the rugs from the carriage and insisted on going with him to his home, that they all felt guilty for their unwarranted assault on the unoffending mill-owner.

LORD RAVENEL'S PROPOSAL AND SOME GOOD ADVICE TO THE YOUNG LORD

John Halifax, on his part, promised to do all he could to help them, and thus not only taught them a lesson in good conduct, but proved to Lord Ravenel that the "lower orders," even in their misguided folly, were worthy of something better than being ridden down by rich men's carriages.

Lord Ravenel had returned to reside again at Luxmore Hall, and his visits to Beechwood became as regular as they had been in the old days at the Halifax home, when Muriel was alive. It was the society of Maud in which Ravenel now delighted, though he never forgot the serene and happy days he had spent with her blind sister, who was no more.

It was not altogether to the liking of Mr. and Mrs. Halifax when they discovered that their second son, Edwin, loved Miss Silver, the governess. But John Halifax was not the man to allow any false feeling of pride to stand in the way of his son's happiness, and so the old Norton Bury house was given to Edwin and his bride, for them to begin housekeeping where John and Ursula had begun before them.

Soon after this, Lord Ravenel sought to be regarded as suitor for the hand of Maud, who would thus have become the future Countess of Luxmore. He said that he would wait two years for her, if her father wished it; but John Halifax would make him no promise, and urged him rather to endeavor first to become a more worthy man, so that he might do something to redeem the evil reputation which the conduct of his own father had brought upon the name of Luxmore.

"Do you recognize what you were born to be?" said Halifax to him. "Not only a nobleman, but a gentleman; not only a gentleman, but a man —man made in the image of God. Would to Heaven that any poor word of mine could make you feel all that you are—and all that you might be!"

THE YEARS PASS BY AND THERE IS HAPPY NEWS OF GUY HALIFAX

"You mean, Mr. Halifax, what I might have been—now it is too late."

"There is no such word as 'too late' in the wide world—nay, not in the universe," said John Halifax.

Lord Ravenel for a time sat silent; then with a sudden effort he rose to go, and, thanking Mrs. Halifax for all her kindness, he said, in a voice choked with emotion:

"For your husband, I owe him more than kindness, as perhaps I may prove some day; if not, try to believe the best of me you can. Good-bye!"

It was not many weeks after this that the old Earl of Luxmore died in France, and it then became known that his son, who succeeded to the title, had voluntarily given up his claims on the estate in order to pay the heavy debts of his worthless father.

The home at Beechwood had lost another inmate when Guy first went to Paris and later sailed for America. Years passed by, and he became a successful merchant in Boston, and then one day he wrote home to say he was coming back to the Old Country to be with his father and mother again, and was bringing with him the partner in his business.

The ship in which Guy and his friend sailed from America was wrecked, and Ursula, in her grief at the supposed loss of her eldest son, seemed to be wearing away, when one day a strange gentleman stood in the doorway—tall, brown, and bearded—and asked to see Miss Halifax. Maud just glanced at him, then rose from her chair, and said somewhat coldly:

"Will you be seated?"

"Maud, don't you know me? Where is my mother?"

The return of the son whom she had given up for dead brought joy again to the heart of Ursula, and her health seemed to revive, but it was clear that the number of her days was now uncertain.

YOUNG LORD RAVENEL PROVES THAT JOHN HALIFAX WAS RIGHT

Scarcely less than the delight in Guy's return was the discovery that his partner was none other than the new Earl of Luxmore, who, as plain Mr. William Ravenel, had by his life in America proved John Halifax was right when he said it was not too late for him to model his life on lines of true manliness. He had, indeed, become all that John had desired of him—a man and a gentleman —so that Maud was, after all, to be the Countess of Luxmore.

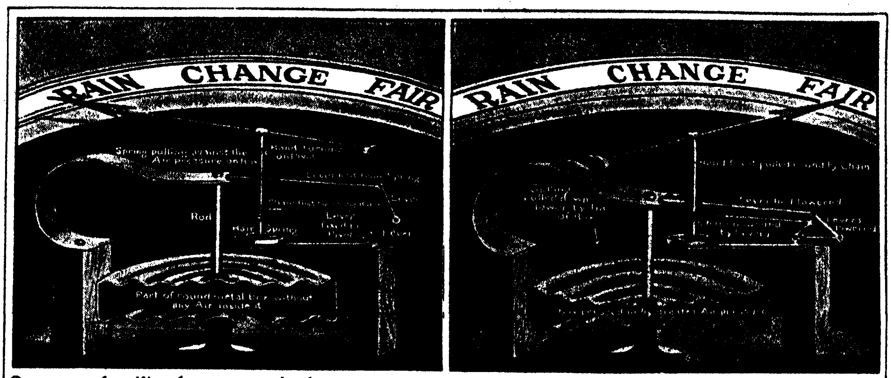
But the days of John Halifax himself were now drawing to a close, and he was not without premonitions of his end; for in his talks with Phineas Fletcher, who had remained his faithful companion all these years, he spoke as one would speak of a new abode, an impending journey. Death came to him very gently one day at sunset, just after he had greeted Phineas with a smile when his old friend, looking towards Lord Luxmore and his future bride, who were with a group of the young people, had said:

"I think sometimes, John, that William and Maud will be the happiest of all the children."

THE PEACEFUL END OF A NOBLE AND BEAUTIFUL LIFE

He smiled at this, and a little later seemed to fall asleep; but when Maud came up and spoke to him, he was dead. While he was sleeping thus, the Master had called him. His sudden end was so great a shock to the frail life of Ursula, that in a few hours she followed him. When they buried John Halifax in the pretty Enderley churchyard they laid his wife of three-and-thirty years to rest beside him.

THE NEXT FAMOUS BOOKS ARE ON PAGE 4069.



One very familiar barometer is the aneroid barometer. The first picture shows its various parts and the second shows how these work. The air presses down with greater or less force upon the metal box, from which all the air has been exhausted, and this moves the hand, or indicator.

THE PRESSURE OF THE AIR

CONTINUED FROM 3888

WE are all aware that there are many different kinds of pressure. For instance, we realize what it is to press with the finger against anything, and whenever we use the word pressure, that is the kind of idea we may have in our minds. When we hold anything in the hand, we feel its pressure due to gravitation; and that is a kind of pressure which we know well, and which applies equally to all the different states of matter: solid, liquid, and gaseous. We also know that there is another kind of pressure exerted by rays, or radiation, in the ether, such as light, which is therefore called radiation pressure. We mention this kind of pressure because the discovery of it bears so greatly upon our ideas as to what must be the consequences of gravitation some day.

We must now pass on to the consideration of some other kinds of pressure, and we shall see that here we have again to learn of measurement. Just as we had special means for measuring gravity and specific gravity, and so forth, so special means have been invented for measuring the kinds of pressure we are about to discuss.

We speak of matter as either solid or liquid or gaseous; but of these three states in which we may find matter, two are much more like each other than either is like the third. Water is very different from the air above it; but there is one very important respect in which the water and the air are far more like each other than either of them is like the solid ground, and that is that they will both of them run, or flow.

In the solid ground there are forces holding together the molecules, so that the shape of the whole is maintained; but the shape of the air or water—if we can speak of such a thing—changes from moment to moment if it is allowed to, because both air and water flow. So liquids and gases are known in the language of science as fluids, which simply means things that flow. In ordinary language, liquid and fluid mean the same thing; but the point for us to understand is that gases also have to be reckoned as fluids, because, like liquids, they flow.

Now, in any fluid, at any time, and at any place, there is a certain pressure which is called fluid pressure, and there is at least one instance of fluid pressure which we have all measured many times, though perhaps we did not know that we were doing so. That is the pressure of the air.

This atmospheric pressure, as it is usually called, is by far the most important kind of fluid pressure for our lives; and we must spend a little time in studying it carefully. We know that we really live at the bottom of a great ocean of air. On the floor of this ocean we live and crawl about, and if we can swim in it for a little while at a small height—as we do in flying machines—we are very proud of ourselves.

HOW THE AIR PRESSES INTO OUR LUNGS AND ENABLES US TO LIVE

Everywhere in this immense ocean there is fluid pressure. Perhaps the first and most important consequence of this fluid pressure is that it enables us to breathe. What happens when we breathe is that we make a movement which tends to empty the space in our lungs of everything; but as that space is in communication with the outer air, the atmospheric pressure drives some of that outer air into the space we make. Thus, without the atmospheric pressure we could not breathe, and, therefore, could not live.

Now, it is only some three hundred years ago since, in studying a case like this, men said that the reason why air or anything else would rush into an empty space, if it could, was that Nature objected to anything being empty. The phrase which they used, and which they accepted as an explanation, was *Nature abhors a vacuum*—vacuum being simply the Latin for an empty place. But, just about three centuries ago, it was discovered why Nature abhors a vacuum, and also to what extent Nature abhors a vacuum. It was found that what really happens is always the consequence of fluid pressure. We owe this great discovery not directly to Galileo himself, but to another Italian named Torricelli, the most famous of Galileo's pupils.

We all know that it is possible by means of a pump to pull up water; and it was found that there was a certain height to which water would rise in a pump—about thirty feet.

A FAMOUS ITALIAN WHO DISCOVERED THE GREAT SECRET OF THE ATMOSPHERE

But no pump will make water rise, say, fifty feet. Thus it was remarked that there is a limit to Nature's dislike of a vacuum! Torricelli thought that other fluids would behave as water does. He thought, also, that the water rises in a pump because of the pressure of the atmosphere, and that if he took a much heavier fluid than water, it also would rise, but, being heavier, would rise so much less. He took the heaviest of all fluids, which is mercury, and he proved that the mercury does rise in the same way as water does, but to a much lower height in proportion, as mercury is heavier than water.

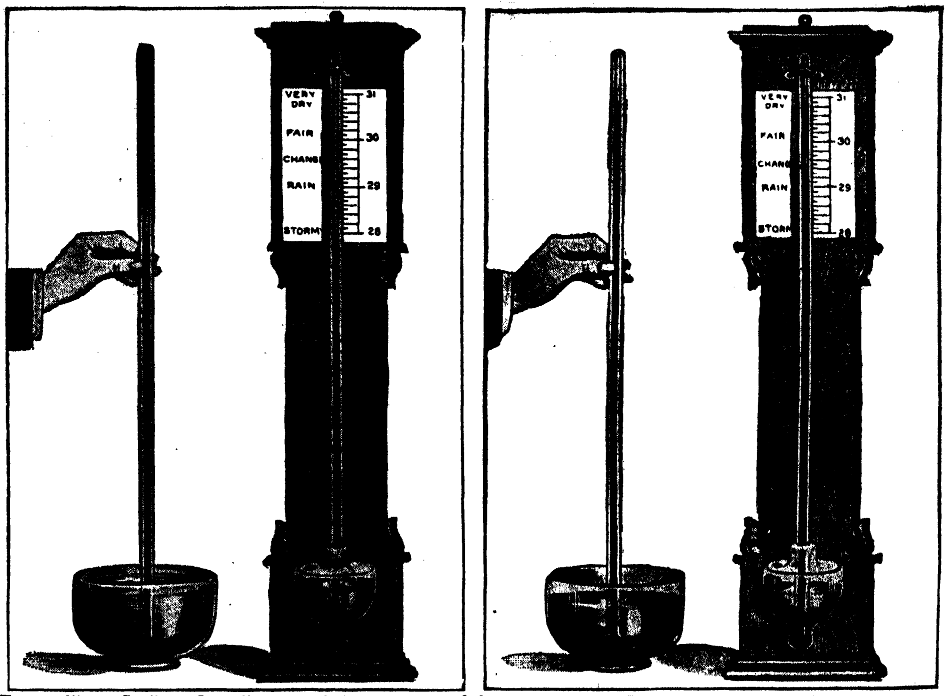
It is very easy to understand the famous experiment of Torricelli, which proved, for the first time, the existence of the atmospheric pressure, and explained why it is that Nature abhors a vacuum. If we take a fine glass tube and fill it with mercury, and then turn it upside down in a cup that already contains mercury, what will happen to the mercury inside the tube? We might expect that all the mercury would run out of the tube into the cup; but, in point of fact, it does not. Something holds up the column of mercury in the tube. The earth, we know, is pulling by gravitation upon that column of mercury. What is the opposing force that holds it up? The answer is that it is the atmospheric pressure pressing down upon the surface of the mercury in the cup, and, so to speak, pressing some of it up into the glass tube.

THE PRESSURE OF AIR THAT WILL BALANCE A COLUMN OF METAL

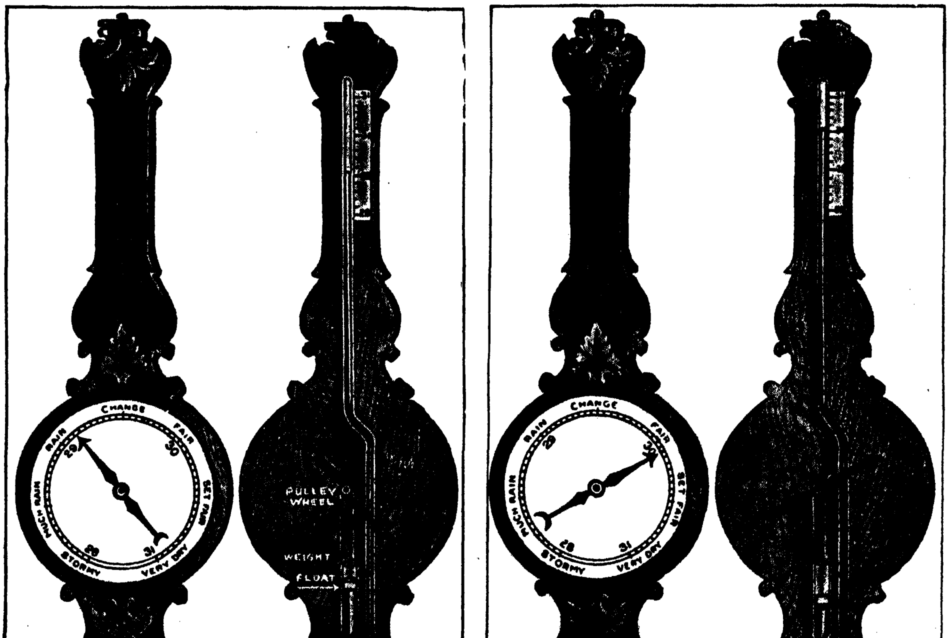
Now, if the tube is short, the mercury will fill it; but if we use a long tube, say, three feet long, and if, having filled it with mercury, we turn it upside down in a cup of mercury, the column of mercury will not be completely held up. On the average, the mercury will drop about six inches. In other words, the pressure of the atmosphere is, as a rule, about equal to supporting a column of mercury thirty inches high.

It is interesting to ask what fills the space in the tube above the level of the mercury when the mercury drops. There cannot be any air there; and we might suppose that there must be nothing there—that it must really be a genuine vacuum. In point of fact, it is as nearly a perfect vacuum as we can obtain, and it has been known, since the time we are speaking of, as a Torricellian vacuum; but it is not perfectly empty, for liquid mercury very easily turns itself into a gas, or vapor, and so, though there is no air in a Torricellian vacuum, it

HOW THE BAROMETER TELLS THE WEATHER



Torricelli, an Italian, first discovered the pressure of the atmosphere. These pictures show his experiment and how it is adapted to the standard barometer. A column of mercury is supported in a tube, standing in a bowl of mercury, by the pressure of air on the mercury in the bowl. When the air is light, the mercury sinks in the tube, as in the first picture ; but the pressure of heavy air drives the mercury up, as in the second.



In these pictures we see what is known as the siphon barometer, with a siphon-shaped tube, a dial, and an indicator. The face has been removed to show how the hand works. As the mercury rises or falls in the open end of the tube, an ivory weight moves up or down, and, by means of a chain over a wheel, turns the hand.

contains a certain amount of the vapor of mercury. It is in some degree possible, by various means, to prevent the mercury from evaporating much ; and so we can get in such a tube the nearest approach to empty space that is possible for us, although we may just remind ourselves that, however empty of ordinary matter we make this space, the ether, that fills all space, will even be there.

HOW WE ARE ABLE TO MEASURE THE PRESSURE OF THE ATMOSPHERE

Now, we have noticed that it is possible to measure the length of a column of mercury in one of these tubes, and so, if the atmospheric pressure were greater or less one day than the next, we ought to notice that the column of mercury in the tube is of a different length on the two days. If the atmospheric pressure is high, strong, and pressing down more firmly on the surface of the mercury in the vessel, then it ought to be able to hold up a longer column of mercury ; and if the atmospheric pressure is low, it will not hold up such a long column of mercury.

When we think of a man pressing down with his fist on a table, or think of the game people sometimes play at fairs when a man strikes with a hammer upon a knob, and the harder he strikes the higher a weight runs up a pole, we realize what happens in the case of the column of mercury. Thus, this experiment of Torricelli's not only proves the existence of the atmospheric pressure, but it also enables us to measure it.

But, apart from such changes as may occur owing to something happening in the atmosphere, we ought to be able to show that if we rise high up in the atmosphere, the column of mercury in the tube falls, because the higher we rise, the less is the weight of air above us, and the less must be the atmospheric pressure. In the same way the pressure of water increases as we go downwards into the sea, as every diver knows.

WHAT HAPPENED ONE DAY TO A TUBE OF MERCURY ON A MOUNTAIN

A still more famous man than Torricelli, the great French thinker Pascal, made this experiment very shortly after Torricelli's work was begun. He took one of Torricelli's tubes up to a considerable height, and found when he got there that the level of the mercury was much lower than it had been. As he came down again he watched the mercury, and found that its level rose, because there was now a greater pressure of the atmosphere upon the surface of the mercury contained in the vessel. The variation of the atmospheric pressure at different heights has many interesting results. For instance, when men go up in a balloon, they feel the consequences of the steady lessening of the pressure upon which breathing depends, and they may suffer very severely. There is a thing called mountain sickness, which might also be called balloon sickness, and which depends upon this lessening of the atmospheric pressure. A good many people sleep badly at low pressures of the atmosphere—that is to say, when they go among the mountains—and do better at the sea, where, of course, the pressure of the atmosphere is as high as it can be.

It has lately been proved, also by an Italian—and that is quite appropriate—that when people have lived for a few days at some great height, the body produces a greatly increased number of red blood cells—those which carry oxygen from the lungs to the tissues.

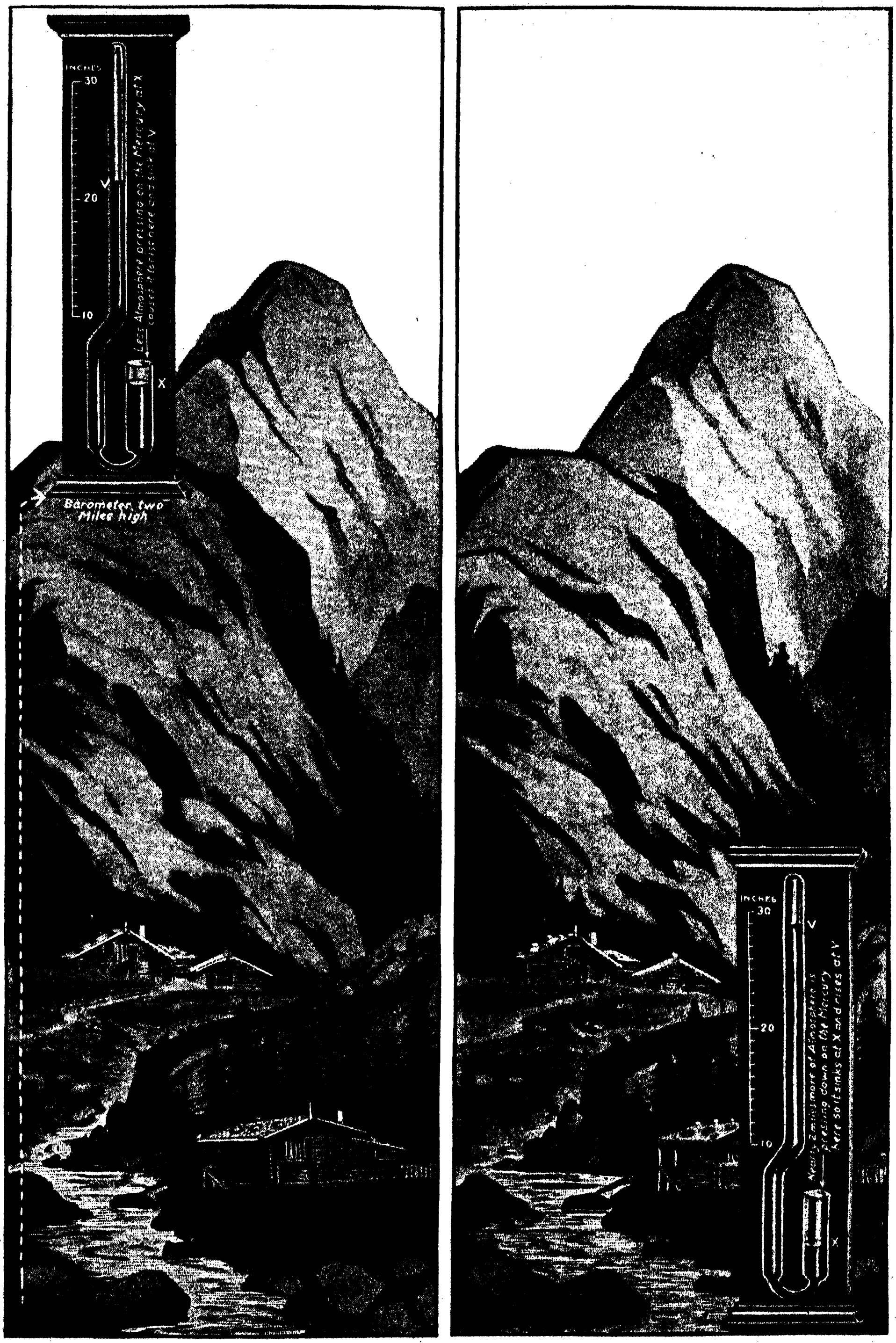
THE WONDERFUL WAY IN WHICH OUR BODY FITS ITSELF TO AIR PRESSURE

On a mountain-top the air is so rare, as we say, or the atmospheric pressure so low, that the body must make special arrangements accordingly. It is very wonderful indeed that the body can adapt itself in this fashion to the altered conditions of the atmosphere.

Now, if in a Torricelli tube we have a means of measuring the pressure of the atmosphere, we have what we may call a barometer, which really means a weight measurer ; and that is why it was said just now that there is one kind of fluid pressure which we have all of us measured many times. Every time we have looked at the barometer we have really been measuring the pressure of the atmosphere, for that is all that the barometer does.

No doubt our ordinary way of reading the barometer rather hides what we are really doing. We simply look to see if a little pointer is pointing to "Set fair" or to "Changeable," and we look on the barometer as a thing that prophesies the kind of weather that we are going to have. As a matter of fact, however, it does nothing but measure the atmo-

MEASURING A MOUNTAIN WITH AIR



The height of a mountain can be measured with a barometer. In the left picture we see a barometer on a mountain two miles high. The pressure of the atmosphere on the cistern, X, causes the mercury to rise in the tube, V. Down in the valley, the greater weight of the air on the cistern makes the mercury rise higher in the tube, and by comparing the two readings of the barometer the height of the mountain is calculated.

spheric pressure at the place and time in question. The pointer is so made as to indicate the height in inches of the column of mercury which the atmosphere will hold up, then and there.

WHY A BAROMETER TELLS US WHAT THE WEATHER WILL BE

The relation of the barometer to the weather lies in the fact that, on the whole, the most important thing in deciding the weather is the atmospheric pressure. If the atmospheric pressure is very high at a place, there will be no disturbance there ; but if it is very low, then air will be rushing towards that place from other places where the pressure is higher. That means wind, and wind may mean rain. So we see where the connection between the barometer and the weather comes in ; and when we find, as we sometimes do, that the barometer cannot quite be trusted as a weather-glass, we must remember that the causes of the weather are very complicated, and that the atmospheric pressure, though the most important of them, is only one of them. We have a way of giving things names according to the use to which we put them, and so we may call the mercurial barometer a weather-glass, but that is certainly not its proper name.

For the matter of that we might call it a mountain measurer ; for, as we can now quite readily understand, this simple instrument actually gives us a way of discovering how high a mountain is. All we have to do is to find out how much the mercury in it falls for every thousand feet that we go up, and then we can reckon how high a mountain is. There is, however, one serious condition attached to this method, which is—first climb your mountain ! That is often impossible ; and in any case there are more accurate ways of measuring the heights of mountains than with a barometer.

HOW THE MERCURY IN THE TUBE MOVES THE POINTER OF THE BAROMETER

The ordinary barometer that we see everywhere is really just Torricelli's instrument ; but the end of the tube is usually turned up so as to make it U-shaped, instead of having the tube straight and the end of it in a vessel of mercury. If we float an iron ball on the top of the mercury, where the tube is open, we can easily attach to the ball some arrangement with a pointer which can tell us what the height of the mercury is in the tube, or it can be made to point to words like fair or rain.

There is another kind of barometer which has no mercury or any other liquid in it, and which is called an aneroid barometer. This literally means the barometer that has no fluid in it. It is simply a round, flat, metal box which has been emptied of air as far as possible. The top and the bottom of the box are pressed towards each other by the atmosphere more or less, according to whether the atmospheric pressure is high or low, and it is not difficult to make arrangements by which we can easily read off the extent to which the box is being pressed. The results attained by this instrument are not at all precise, but it is quite useful to have in the house as a weather-glass.

If we took an ordinary mercury barometer and made it warm, the mercury would expand, and take up more space in the tube, as most things do when they are warmed. Therefore, if we want our results to be precise, we should always be able to allow for the temperature when using a barometer.

THE AIR PRESSES UPON US EQUALLY IN ALL DIRECTIONS

So a good barometer always has a thermometer, or heat measurer, with it. In making a barometer, we should first boil the mercury, so as to get out of it all the air and water-vapor that we can. If we omit to do this, of course the air and water-vapor will pass out of the mercury, when we have made our barometer, into the Torricellian vacuum at the top of the tube, and they will prevent the mercury from rising as high as it ought to do.

If we take our reckoning at Washington, as we generally do, we find that the pressure of the atmosphere is equal to the pressure of rather more than fourteen pounds on every square inch of surface. Our own bodies are, of course, exposed on every square inch of their surface to this great pressure ; and if the pressure were wholly a downward one, weighing upon our heads, we could not stand it. But a great law about fluid pressure is that at any place it is the same in all directions. Therefore, though we are pressed down upon, we are also pressed in upon from the side, and thus we are equally supported from

all directions, and the atmospheric pressure does us no harm. If it should happen that at any part of our bodies we were not equally pressed upon, we should soon notice a rather startling result. If we take a little glass tube, and burn something in it, so that it becomes filled with hot air, and then quickly press the mouth of it against the skin, it is interesting to see what follows. The air inside the tube is very hot, and air, we know, like most things, stretches, or expands, when it is hot. But in a little while the air becomes cooled, and as it cools it shrinks. This means that the pressure inside the tube is lower than outside it. Another way of putting this is that the pressure on the piece of skin covered by the tube is less than the general atmospheric pressure upon the rest of the body.

The laws of force are bound to have their way; the pressure upon the skin outside the tube squeezes some of the fluids of the body up into the tube, and the skin inside the tube—which is not being pressed upon as the rest of the skin is—is forced up into the tube by the pressure of the fluid underneath it, sometimes quite a long distance, forming a sort of little finger of skin.

A BOY'S GAME THAT PROVES A SCIENTIFIC LAW

If a student has nothing better to do, and puts three or four such tubes on his forehead, and walks about with them sticking there, he looks very absurd indeed, but he teaches those who see him that the pressure of the atmosphere upon the surface of our bodies is a very real thing.

The game that boys play with a sucker and a stone also depends on the atmospheric pressure. We know that a piece of soft leather, when moistened, will catch on to a stone and lift it up; but, of course, the instant the corner of the leather is raised, and the air is allowed to rush in, the stone will drop. If boys could live on the moon they certainly could not play this game there, because the moon has practically no atmosphere.

We have already learned that it is the atmospheric pressure by which we breathe. Sometimes, however, instead of wishing to draw air into our lungs, we wish to draw water into our mouths. Take the case of sucking lemonade through a straw, or of filling a syringe with ink for a fountain-pen. It is the atmospheric pressure that we use in these cases, too. When we suck through the straw, all we do is to lower the pressure at the end of the straw that is in our mouths, and then the pressure upon the surface of the fluid in the tumbler pushes some of it up the straw.

WHY THE WATER COMES OUT OF THE PUMP

If we keep the tip of our tongue over the end of the straw, we can hold the column of fluid in the straw in spite of the attraction of gravity. But when we take our tongue away and allow the pressure at both ends of the straw to be equal, gravity has no force to oppose it, and the column of fluid falls.

Such use of a straw is just the same as the way in which a syringe is filled; and an ordinary pump is just the same as a syringe. Inside the pump there is a thing called a piston which fits it closely, and when the piston is raised, it lowers the pressure inside the pump, and liquid is sucked up—that is to say, pushed into the pump from outside by the atmospheric pressure. It is a mere detail whether, when we have got the liquid into the thing, we send it out by the way it came, as we do in a garden syringe, or whether we provide another opening for it somewhere else, as we do in a pump.

We all know those bottles that are often called siphons, which are so made that the liquid in them will run up a long tube and then down another. Properly, we should simply call the tube itself a siphon. If we take such a bent tube quite apart from the bottle, and fill it with water, and then put one end of it in a tumbler of water, as the picture upon page 733 shows, the water will all run out at the other end.

WHY A SIPHON WILL EMPTY A GLASS OF WATER

Atmospheric pressure acts on both ends of the siphon equally, so as to keep that part of the tube which rises above the level of the water in the tumbler full of water. The force of gravity now pulls on the water in the two arms of the siphon. The water in the longer arm being heavier causes a movement in the direction of the longer arm. As water escapes from

the end of the longer arm, more water takes its place from the tumbler. This goes on until the tumbler is emptied. The flow would stop if the water in the two arms of the siphon became the same in height.

The atmospheric pressure is the most important, and perhaps the easiest to understand, of all kinds of fluid pressure. When we go more closely into the laws of fluids, we find them exceedingly difficult, yet one or two of the great results are easy to understand. The law that the pressure of a fluid at any point is equal in all directions has already been mentioned. If, however, we are to state this law quite correctly, we must add one more word. We must say not "a fluid," but "a motionless fluid." Of course, directly we introduce a new thing—which is the motion of the fluid—then the whole case is changed. For instance, we do not feel the atmospheric pressure to any noticeable extent, but we *do* feel the wind.

AN EXTRAORDINARY MAN WHO DISCOVERED THE LAW OF EQUAL PRESSURE

This law of the equality of fluid pressure in all directions stands to the credit of that extraordinary Frenchman Pascal, whom we have already mentioned. He is to be called extraordinary because his mind was so complete. People who study religion and duty and good and evil have to read the works of Pascal, because he thought so wisely and deeply on those subjects; people who study pure mathematics have to make acquaintance with Pascal; and people who study what happens in a tumbler of water have to study Pascal, too. In the whole history of mankind there are only a very few cases like this.

Now, it is interesting to invent an experiment to prove the truth of Pascal's law. If we take an empty bottle and cork it, and push it down into deep water, or rather sink it by attaching a weight to it, the fluid pressure will force the cork into the bottle. Now, we find that it does not matter whether the bottle is right side up or upside down, or placed at any angle, the result is just the same. Therefore, to take the case of a fish swimming in the water, it is subjected to a pressure which is upwards as well as downwards and sideways. The point is that the fluid has no greater tendency to press anything in one direction more than in another. Here we find the great difference between fluid pressure and the pressure of this book on the table, or the table on the floor, or the beams of the roof against the walls of the house. The pressure exerted by one solid thing on another is in one direction only.

GASES THAT CAN BE SQUEEZED AND LIQUIDS THAT CANNOT

The great laws of fluid pressure are the same for both kinds of fluids; but it is very plain to everyone that, however true this may be, there must be some very great difference between the kind of fluid we call a gas and the kind we call a liquid. If we take any gas, or mixture of gases, and squeeze it, we find that it can be squeezed. When we cease to apply the force by which we squeeze it, then it expands again. The proper way of saying this is that a gas is compressible; but the other kind of fluid, which we call a liquid—as, for instance, water—is, practically, not compressible.

It has been proved comparatively recently that it is possible, with very great pressure indeed, to compress water a very little. We should understand this; but still there remains the great difference that a gas is readily compressible, and that a liquid is for all practical purposes quite incompressible. Now, as gases can be compressed by pressure, we ought to know whether there is any law governing the results. There is such a law, and that is the last thing we need learn in this part of our subject.

THE DISCOVERY OF ROBERT BOYLE WHICH EXPLAINS A GAS EXPLOSION

It was discovered by, and is named after, a celebrated Englishman named Robert Boyle, who lived in the seventeenth century. Boyle's law says that if the temperature of a gas remains the same, the greater its pressure the less space it fills. If this pressure is to rise, the volume must fall; and if the pressure is to fall, the volume must rise. This means that a certain proportion of gas will exert more pressure in proportion as it occupies a smaller space. We realize this when we cause a great explosion, by suddenly making a lot of gas in a very little space.

THE NEXT PART OF THIS IS ON PAGE 4083.

A POEM OF SORROW, FAITH, AND HOPE

As printed among the poet's works, this is a long poem of one hundred and thirty-one sections, with a prologue and an epilogue. It is really a collection of short poems written on different occasions over a period of some sixteen years. As stated on page 2191, the whole is dedicated to the memory of a dear friend of the poet, Arthur Henry Hallam, who was expected, by all who knew him, to become one of the most notable men of England, but died suddenly at Vienna on September 15, 1833, and was brought back by sea and buried at Clevedon, on the Bristol Channel, January 3, 1834. Tennyson's grief at the loss of his friend was so intense that, for many years, the death of Hallam had a constant influence on the poet's life, turning his thoughts to the contemplation of man's destiny, and the effect of grief in purifying the mind of man. The sections are numbered in order here, but the numbers are not, of course, the same as those in the whole poem.

TENNYSON'S "IN MEMORIAM"

CONTINUED FROM 3872

STRONG Son of God, immortal Love,
Whom we, that have not seen Thy face,
By faith, and faith alone, embrace,
Believing where we cannot prove;

Thine are these orbs of light and shade;
Thou madest Life in man and brute;
Thou madest Death; and lo, Thy foot
Is on the skull which Thou hast made.

Thou wilt not leave us in the dust:
Thou madest man, he knows not why,
He thinks he was not made to die;
And Thou hast made him: Thou art just.

II.

IN GRIEF'S FIRST HOUR

Tennyson's great poem begins as above, striking at once a note of confident hope in the goodness and mercy of God. Overshadowed by the loss of his dear friend, he naturally asks himself whether he and his friend will live again, and continue in another life the friendship of this. He has been studying works of philosophy concerning the origin of the world and man, but from them he only comes to know that we cannot understand the inner mysteries of the world and life, and must be content with simple faith in God's mercy. But despite his faith, he finds himself wandering sorrowfully in the street where his beloved friend had lived.

Dark house, by which once more I stand
Here in the long unlovely street,
Doors, where my heart was used to beat
So quickly, waiting for a hand,

A hand that can be clasp'd no more—
Behold me, for I cannot sleep,
And like a guilty thing I creep
At earliest morning to the door.

He is not here; but far away
The noise of life begins again,
And ghastly thro' the drizzling rain
On the bald street breaks the blank day.

III.

THE LAST JOURNEY OF THE DEAD

"Every pleasant spot" where the friends had been in the habit of meeting now seems dark to him, and blank despair has for the moment driven hope and faith away. The poet's soul has now begun to feel with a new keenness in his grief, but his thoughts are again sweet and gentle when he contemplates the last journey of his dead friend over seas to the quiet resting-place by the waters of the Severn.

Fair ship, that from the Italian shore
Sailest the placid ocean-plains
With my lost Arthur's loved remains,
Spread thy full wings, and waft him o'er.

So draw him home to those that mourn
In vain: a favourable speed
Ruffle thy mirror'd mast, and lead
Thro' prosperous floods his holy urn.

I hear the noise about thy keel;
I hear the bell struck in the night:
I see the cabin window bright;
I see the sailor at the wheel.

Thou bring'st the sailor to his wife,
And travell'd men from foreign lands;
And letters unto trembling hands;
And, thy dark freight, a vanish'd life.

So bring him: we have idle dreams:
This look of quiet flatters thus
Our home-bred fancies: O to us,
The fools of habit, sweeter seems

To rest beneath the clover sod,
That takes the sunshine and the rains,
Or where the kneeling hamlet drains
The chalice of the grapes of God;

Than if with thee the roaring wells
Should gulf him fathom-deep in brine;
And hand so often clasp'd in mine
Should toss with tangle and with shells.

IV.

IF THE LOST CAME BACK

"Is this the end of all my care?" the poet asks himself when the body of his friend has been hidden in the dark grave. In the depth of his grief his reason is not calm enough to answer him, and he can only resign himself to his sorrow and to what time may teach him. In these verses he expresses the commonest feelings of humankind: the difficulty at first of believing that a dear friend, who has just died, will never meet us and speak to us again in this world.

If one should bring me this report,
That thou hadst touch'd the land to-day,
And I went down unto the quay,
And found thee lying in the port;

And standing, muffled round with woe,
Should see thy passengers in rank
Come stepping lightly down the plank,
And beckoning unto those they know;

And if along with these should come
  The man I held as half divine;
  Should strike a sudden hand in mine,
And ask a thousand things of home;

And I should tell him all my pain,
  And how my life had droop'd of late,
  And he should sorrow o'er my state,
And marvel what possess'd my brain;

And I perceived no touch of change,
  No hint of death in all his frame,
  But found him all in all the same,
I should not feel it to be strange.

V.

NATURE'S SOOTHING INFLUENCE

"Calm despair and wild unrest" are now the two opposing feelings struggling within him, but when he comes again to the grave of his friend, the very gentleness of the natural scenes has a soothing influence on his spirit, and he writes:

The Danube to the Severn gave
  The darken'd heart that beats no more;
  They laid him by the pleasant shore,
And in the hearing of the wave.

There twice a day the Severn fills;
  The salt sea-water passes by,
  And hushes half the babbling Wye,
And makes a silence in the hills.

The Wye is hush'd nor moved along,
  And hush'd my deepest grief of all,
  When fill'd with tears that cannot fall,
I brim with sorrow drowning song.

The tide flows down, the wave again
  Is vocal in its wooded walls;
  My deeper anguish also falls,
And I can speak a little then.

VI.

MEMORIES OF THE LOST FRIEND

His grief is still a purely personal emotion, and has not yet led him into the wider and deeper feelings which we call "universal," because they embrace mankind as a whole. It is still of their old remembered companionship he sings.

The path by which we twain did go,
  Which led by tracts that pleased us well,
  Thro' four sweet years arose and fell,
From flower to flower, from snow to snow:

And we with singing cheer'd the way,
  And, crown'd with all the season lent,
  From April on to April went,
And glad at heart from May to May:

But where the path we walk'd began
  To slant the fifth autumnal slope,
  As we descended following Hope,
There sat the Shadow fear'd of man;

Who broke our fair companionship,
  And spread his mantle dark and cold,
  And wrapt thee formless in the fold,
And dull'd the murmur on thy lip,

And bore thee where I could not see
  Nor follow, tho' I walk in haste;
  And think that, somewhere in the waste,
The shadow sits and waits for me.

VII.

THE SACRIFICE OF LOVE

But in the presence of this "Shadow cloaked from head to foot," which is, of course. Death, "who keeps the keys of all the creeds," the poet begins to ponder over the great mysteries of man's life and destiny. His thoughts of life, however, are always involved with memories of his friend.

I know that this was Life—the track
  Whereon with equal feet we fared;
  And then, as now, the day prepared
The daily burden for the back.

But this it was that made me move
  As light as carrier-birds in air;
  I loved the weight I had to bear,
Because it needed help of Love:

Nor could I weary, heart or limb,
  When mighty Love would cleave in twain
  The lading of a single pain,
And part it, giving half to him.

VIII.

THE LESSONS OF LIFE

From his personal feelings he now begins to draw the real lessons of life, and as the wildness of despair gives place at length to more reasonable and calmer thoughts, he is able to contemplate his loss with calmness and resignation.

I envy not in any moods
  The captive void of noble rage,
  The linnet born within the cage,
That never knew the summer's woods.

I envy not the beast that takes
  His license in the field of time,
  Unfetter'd by the sense of crime,
To whom a conscience never wakes;

Nor, what may count itself as blest,
  The heart that never plighted troth,
  But stagnates in the weeds of sloth;
Nor any want-begotten rest.

I hold it true, whate'er befall,
  I feel it, when I sorrow most,
  'Tis better to have loved and lost
Than never to have loved at all.

IX.

THE MESSAGE OF THE BELLS

Then, with the approach of Christmastide, and all its holy memories, he finds his very sorrow touched with joy. New feelings of hope, and a serene happiness born of his rising faith in God's mercy, now dwell in that breast where so recently the wildness of sorrow and despair had reigned.

The time draws near the birth of Christ;
  The moon is hid, the night is still,
  The Christmas bells from hill to hill
Answer each other in the mist.

Four voices of four hamlets round,
  From far and near, on mead and moor,
  Swell out and fail, as if a door
Were shut between me and the sound:

Each voice four changes on the wind,
  That now dilate, and now decrease,
  Peace and goodwill, goodwill and peace,
Peace and goodwill, to all mankind.

This year I slept and woke with pain,
  I almost wish'd no more to wake,
  And that my hold on life would break
Before I heard those bells again;

But they my troubled spirit rule,
  For they controlled me when a boy;
  They bring me sorrow touch'd with joy,
The merry, merry bells of Yule.

X.

THE POET'S FAITH AND DOUBT

His faith in the promises of God, as revealed to us in the teachings of Jesus, is not yet absolute, and his mind is not without its doubts, but he has emerged from his darkest sorrow with the conviction that the grave is not the end of all.

My own dim life should teach me this,
  That life shall live for evermore,
  Else death is darkness at the core,
And dust and ashes all that is;

This round of green, this orb of flame,
  Fantastic beauty; such as lurks
  In some wild Poet, when he works
Without a conscience or an aim.

What then were God to such as I?
  'Twere hardly worth my while to choose
  Of things all mortal, or to use
A little patience ere I die.

'Twere best at once to sink to peace,
  Like birds the charming serpent draws,
  To drop head-foremost in the jaws
Of vacant darkness and to cease.

XI.

DO THE DEPARTED THINK OF US

It is springtime again, and the poet still is singing his mournful songs in memory of his friend. For the first time we find him wondering whether the spirit of the departed takes any interest in the life on earth, and, if so, he cannot but think these songs of his will be grateful to the spirit's ear.

With weary steps I loiter on,
  Tho' always under alter'd skies
  The purple from the distance dies,
My prospect and horizon gone.

No joy the blowing season gives,
  The herald melodies of spring,
  But in the songs I love to sing
A doubtful gleam of solace lives.

If any care for what is here
  Survive in spirits render'd free,
  Then are these songs I sing of thee
Not all ungrateful to thine ear.

XII.

THE PURPOSE OF ALL LIFE

From this thought he goes on to speculate upon the life of the departed. "How fares it with the happy dead?" he asks and suggests that theirs is indeed the larger life, to which all the joys and sorrows and good and evil of this world we live in are but the dim and bungling preparations.

Oh, yet we trust that somehow good
  Will be the final goal of ill,
  To pangs of nature, sins of will,
Defects of doubt, and taints of blood;

That nothing walks with aimless feet;
  That not one life shall be destroyed,
  Or cast as rubbish to the void,
When God hath made the pile complete;

That not a worm is cloven in vain;
  That not a moth with vain desire
  Is shrivell'd in a fruitless fire,
Or but subserves another's gain.

And moving up from high to higher,
  Becomes on Fortune's crowning slope
  The pillar of a people's hope,
The centre of a world's desire;

Yet feels, as in a pensive dream,
  When all his active powers are still:
  A distant dearness in the hill,
A secret sweetness in the stream.

The limit of his narrower fate,
  While yet beside its vocal springs
  He play'd at counsellors and kings
With one that was his earliest mate;

Who ploughs with pain his native lea
  And reaps the labour of his hands,
  Or in the furrow musing stands;
"Does my old friend remember me?"

XIII.

WHEN GRIEF IS PAST

This, then, is the wide and universal hope that has grown within the soul of the poet, as he has turned from his own personal sorrows to contemplate the sorrows of all mankind, and to look with clearer faith upon the work of God. He has no longer any doubt that God has created man not as the mere creature of a passing day, but as an inheritor of immortal life. He begins also to feel half ashamed of his grief, saying that "The song of woe is, after all, an earthly song," and in the larger love of mankind, which Jesus came to teach, he finds the joy that far outweighs the loss of a friend. Another year has passed; it is Christmas once more.

Again at Christmas did we weave
  The holly round the Christmas hearth;
  The silent snow possess'd the earth,
And calmly fell our Christmas-eve.

The Yule-log sparkled keen with frost,
  No wing of wind the region swept,
  But over all things brooding slept
The quiet sense of something lost.

As in the winters left behind,
  Again our ancient games had place,
  The mimic picture's breathing grace,
And dance and song and hoodman-blind.

Who showed a token of distress?
  No single tear, no mark of pain:
  O sorrow, then can sorrow wane?
O grief, can grief be changed to less?

O last regret, regret can die!
  No—mixt with all this mystic frame,
  Her deep relations are the same,
But with long use her tears are dry.

XIV.

THOUGHTS AT THE COMING OF SPRING

The poet is thus uneasy at the thought that his sorrow for his friend has lessened. It is personal feeling again pushing against the wider love of humanity, and in the following beautiful song of spring he calls upon the warmer season of the year to thaw his frozen sorrow and let it flower again.

Dip down upon the northern shore,
  O sweet new year delaying long;
  Thou doest expectant Nature wrong,
Delaying long; delay no more.

What stays thee from the clouded noons,
  Thy sweetness from its proper place?
  Can trouble live with April days,
Or sadness in the summer moons?

Bring orchid, bring the foxglove spire,
  The little speedwell's darling blue,
  Deep tulips dash'd with fiery dew,
Laburnums, drooping-wells of fire.

O thou, new year, delaying long,
  Delayest the sorrow in my blood,
  That longs to burst a frozen bud
And flood a fresher throat with song.

XV.

WHAT MIGHT HAVE BEEN

His mind is back again entirely with his friend, when he sings thus of what might have been had the lost one lived to marry the poet's sister, to whom he had been engaged.

When I contemplate all alone
The life that had been thine below,
And fix my thoughts on all the glow
To which thy crescent would have grown,

I see thee sitting crown'd with good,
A central warmth diffusing bliss
In glance and smile, and clasp and kiss,
On all the branches of thy blood ;

Thy blood, my friend, and partly mine ;
For now the day was drawing on,
When thou shouldst link thy life with one
Of mine own house, and boys of thine

Had babbled " Uncle " on my knee ;
But that remorseless iron hour
Made cypress of her orange flower,
Despair of Hope, and earth of thee.

I seem to meet their least desire,
To clap their cheeks, to call them mine.
I see their unborn faces shine
Beside the never-lighted fire.

I see myself an honour'd guest,
Thy partner in the flowery walk
Of letters, genial table-talk,
Or deep dispute, and graceful jest ;

While now thy prosperous labour fills
The lips of men with honest praise,
And sun by sun the happy days
Descend below the golden hills

With promise of a morn as fair ;
And all the train of bounteous hours
Conduct by paths of growing powers
To reverence and the silver hair ;

Till slowly worn her earthly robe,
Her lavish mission richly wrought,
Leaving great legacies of thought,
Thy spirit should fail from off the globe.

What time mine own might also flee,
As link'd with thine in love and fate,
And, hovering o'er the dolorous strait
To the other shore, involved in thee ;

Arrive at last the blessed goal,
And He that died in Holy Land
Would reach us out the shining hand,
And take us as a single soul.

What reed was that on which I leant ?
Ah, backward fancy, wherefore wake
The old bitterness again, and break
The low beginnings of content.

XVI.

FAMILIAR SCENES REVISITED

For a time the thoughts of the poet are again entirely with the departed ; then comes a visit to Cambridge, where they had been at college together, but the sense of personal loss is no longer felt, the gloom has lifted from the poet's mind.

I passed beside the reverend walls
In which of old I wore the gown ;
I roved at random thro' the town,
And saw the tumult of the halls ;

And heard once more in college fanes
The storm their high-built organs make,
And thunder-music, rolling, shake
The prophets blazon'd on the panes :

And caught once more the distant shout,
The measured pulse of racing oars
Among the willows ; paced the shores
And many a bridge, and all about

The same grey flats again, and felt
The same, but not the same ; and last
Up that long walk of limes I passed
To see the rooms in which he dwelt.

Another name was on the door :
I linger'd ; all within was noise
Of songs, and clapping hands, and boys
That crash'd the glass, and beat the floor ;

Where once we held debate, a band
Of youthful friends, on mind and art
And labour, and the changing mart,
And all the framework of the land ;

When one would aim an arrow fair,
But send it slackly from the string ;
And one would pierce an outer ring,
And one an inner, here and there ;

And last the master-bowman, he,
Would cleave the mark. A willing ear
We lent him. Who, but hung to hear
The rapt oration flowing free.

From point to point, with power and grace
And music in the bounds of law,
To those conclusions when we saw
The God within him light his face,

And seem to lift the form, and glow
In azure orbits heavenly-wise ;
And over those ethereal eyes
The bar of Michael Angelo.

XVII.

THE MINGLING OF JOY AND REGRET

Through many sections of the poem the writer recalls events in his friendship with his lost companion, but there is always a feeling of joy now in his expressions of grief, no wavering note of doubt when he sings of the greater things of life and immortality. Another Christmas finds him calm of mind and strong in faith, as when he sings " Ring out, wild bells, to the wild sky," and ends that song—see page 2191—with the joyous note " Ring in the Christ that is to be ! "

Now fades the last long streak of snow,
Now burgeons every maze of quick
About the flowering squares, and thick
By ashen roots the violets blow.

Now rings the woodland loud and long,
The distance takes a lovelier hue,
And drown'd in yonder living blue
The lark becomes a sightless song.

Now dance the lights on lawn and lea,
The flocks are whiter down the vale,
And milkier every milky sail
On winding stream or distant sea ;

Where now the seamew pipes, or dives
In yonder greening gleam, and fly
The happy birds, that change their sky
To build and brood ; that live their lives

From land to land ; and in my breast
Spring wakens too ; and my regret
Becomes an April violet,
And buds and blossoms like the rest.

XVIII.

WHAT TIME HAS TAUGHT THE POET

So at last the poet's personal grief has passed away; "lived down," as we say. Time has indeed taught him wisdom, and he is wise in the confident hope that far better than unavailing sorrow for the head is the steady faith in the reunion of friends in after life, "some strong bond which is to be."

Is it, then, regret for buried time
  That keenlier in sweet April wakes,
  And meets the year, and gives and takes
The colours of the crescent prime ?

Not all : the songs, the stirring air,
  The life re-orient out of dust,
  Cry thro' the sense to hearten trust
In that which made the world so fair.

Not all regret : the face will shine
  Upon me, while I muse alone ;
  And that dear voice, I once have known,
Still speak to me of me and mine.

Yet less of sorrow lives in me
  For days of happy commune dead ;
  Less yearning for the friendship fled,
Than some strong bond which is to be.

XIX.

THE END OF MAN

The last thoughts of the poet, freed from all contemplation of his own feelings, are with mankind as a whole, and in his vision he sees the ultimate triumph of life over death, of good over evil. Man is no mere animal, but capable of love and sufferings and hope, and these are but the seeds of what will flower and bear fruit in the after life of the soul.

Whereof the man, that with me trod
  This planet, was a noble type
  Appearing ere the times were ripe,
That friend of mine who lives in God,

That God, which ever lives and loves,
  One God, one law, one element,
  And one far-off divine event,
To which the whole creation moves.

THE FLIGHT OF PETER BELL

The lines which we give here are merely the introductory verses to a long poem by William Wordsworth, entitled 'Peter Bell: A Tale." The whole is a fanciful and not unprofitable story, but the imagination of the poet is seen in its most attractive guise in these introductory verses, which form of themselves a complete little poem.

THERE'S something in a flying horse,
  There's something in a huge balloon ;
But through the clouds I'll never float
Until I have a little Boat
Shaped like the crescent-moon.

And now I have a little Boat,
In shape a very crescent-moon ;
Fast through the clouds my Boat can sail ;
But if perchance your faith should fail,
Look up—and you shall see me soon !

The woods, my Friends, are round you roaring,
Rocking and roaring like a sea ;
The noise of danger's in your ears,
And ye have all a thousand fears
Both for my little Boat and me !

Meanwhile untroubled I admire
The pointed horns of my canoe ;
And, did not pity touch my breast,
To see how ye are all distrest,
Till my ribs ached, I'd laugh at you !

Away we go, my Boat and I—
Frail man ne'er sate in such another ;
Whether among the winds we strive,
Or deep into the clouds we dive,
Each is contented with the other.

Away we go—and what care we
For reason, tumults, and for wars ?
We are as calm in our delight
As is the crescent-moon so bright
Among the scattered stars.

Up goes my Boat among the stars
Through many a breathless field of light,
Through many a long blue field of ether,
Leaving ten thousand stars beneath her :
Up goes my little Boat so bright.

The Crab, the Scorpion, and the Bull—
We pry among them all ; have shot
High o'er the red-haired race of Mars,
Covered from top to toe with scars ;
Such company I like it not.

The towns in Saturn are decayed,
And melancholy Sceptres throng them—
The Pleiads, that appear to kiss
Each other in the vast abyss,
With joy I sail among them.

Swift Mercury resounds with mirth,
Great Jove is full of stately bowers ;
But these, and all that they contain,
What are they to that tiny grain—
That little Earth of ours ?

Then back to Earth, the dear green Earth—
Whole ages if I here should roam,
The worlds for my remarks and me,
Would not a whit the better be ;
I've left my heart at home.

See ! there she is, the matchless Earth !
There spreads the famous Pacific Ocean !
Old Andes thrusts yon craggy spear
Through the grey clouds ; the Alps are here,
Like waters in commotion.

Yon tawny slip is Libya's sands,
That silver thread the river Dnieper ;
And look, where clothed in brightest green
Is a sweet isle, of isles the Queen ;
Ye fairies, from all evil keep her.

And see the town where I was born !
Around those happy fields we span
In boyish gambols ; I was lost
Where I have been, but on this coast
I feel I am a man.

Never did fifty things at once
Appear so lovely, never, never
How tunefully the forests ring !
To hear the earth's soft murmuring
Thus could I hang for ever.

ARMAGEDDON

Armageddon is the name given to the place whereon it is said that God will one day gather all His enemies and destroy them for ever. The idea of such a poetic ending to the forces of evil that prevail in the world is often used by writers, and in this fine poem by Sir Edwin Arnold, who was born June 10, 1832, and died in 1904, it is made the theme of a stirring "war poem of the future"; the eventual great battle in which the right will prevail. The poem is given here by permission of Messrs. Kegan, Paul & Co.

MARCHING down to Armageddon—
Brothers, stout and strong!
Let us cheer the way we tread on
With a soldier's song!
Faint we by the weary road,
Or fall we in the rout,
Dirge or Pæan, Death or Triumph!
Let the song ring out!

We are they who scorn the scorners—
Love the lovers—hate
None within the world's four corners—
All must share one fate;
We are they whose common banner
Bears no badge or sign,
Save the light which dyes it white—
The Hope that makes it shine.

We are they whose bugle rings,
That all the wars may cease;
We are they who pay the Kings
Their cruel price for Peace;
We are they whose steadfast watchword
Is what Christ did teach,
"Each man for his Brother first—
And Heaven, then, for each."

We are they who will not falter—
Many swords or few—
Till we make this earth the altar
Of a worship new;
We are they who will not take
From palace, priest, or code,
A meaner Law than "Brotherhood"—
A lower Lord than God.

Marching down to Armageddon—
Brothers, stout and strong!
Ask not why the way we tread on
Is so rough and long!
God will tell us when our spirits
Grow to grasp His plan!
Let us do our part to-day—
And help Him, helping Man!

Shall we even curse the madness,
Which for "ends of State"
Dooms us to the long, long sadness
Of this human hate?
Let us slay in perfect pity
Those that must not live;
Vanquish, and forgive our foes—
Or fall—and still forgive.

We are those whose unpaid legions,
In free ranks arrayed,
Massacred in many regions—
Never once were stayed;
We are those whose torn battalions,
Trained to bleed, not fly,
Make our agonies a triumph—
Conquer, while we die!

Therefore, down to Armageddon—
Brothers, bold and strong;
Cheer the glorious way we tread on
With this soldier's song!
Let the armies of the old Flags
March in silent dread!
Death and Life are one to us,
Who fight for Quick and Dead!

WHY THE ROBIN'S BREAST IS RED

It is curious to think that James Ryder Randall, the American poet who sang in praise of the Confederates in "Maryland, My Maryland," during the Civil War in this country, and wrote the famous song of the South, "There's Life in the Old Land Yet," was also a writer of tender religious verse. In the following little poem he uses a very old and beautiful legend about the robin redbreast for the purpose of teaching a very necessary lesson in religious life.

THE Saviour, bowed beneath His cross, climbed up the dreary hill,
And from the agonising wreath ran many a crimson rill;
The cruel Roman thrust Him on with unrelenting hand,
Till, staggering slowly 'mid the crowd, He fell upon the sand.

A little bird that warbled near, that memorable day,
Flitted around and strove to wrench one single thorn away.
The cruel spike impaled his breast, and thus, 'tis sweetly said,
The robin has his silver vest incarnadined with red.

Ah, Jesu! Jesu! Son of Man! My dolour and my sighs
Reveal the lesson taught by this winged Ishmael of the skies.
I, in the palace of delight or cavern of despair,
Have plucked no thorns from Thy dear brow, but planted thousands there!

MEMORY

Thomas Bailey Aldrich, a famous American poet, expresses in these lines a curious fact which most people have experienced, though it is not until we have grown up that we notice it. Some quite unimportant events in our lives will be remembered by us far better than we can ever remember dates which are supposed to be of the greatest importance. Perhaps Memory is wiser than we are in thus calling to our mind the things of which we had taken least account.

MY mind lets go a thousand things,
Like dates of wars and deaths of kings,
And yet recalls the very hour—
'Twas noon by yonder village tower,
And on the last blue moon in May—
The wind came briskly up this way,
Crisping the brook beside the road;
Then, pausing here, set down its load
Of pine-scents, and shook listlessly
Two petals from that wild-rose tree.

ROSE AND ROOT

John James Platt, the writer of this little fable in verse, was an American poet of some distinction, born in 1835. The moral of the tiny story is that the real reward of good work is not its being seen by others, but the knowledge which the worker possesses of doing the good work for its own sake.

THE rose aloft in sunny air,
Beloved alike by bird and bee,
Takes for the dark root little care,
That toils below it ceaselessly.

I put my question to the flower:
"Pride of the summer, garden queen,
Why livest thou thy little hour?"
And the rose answered: "I am seen."

I put the question to the root.
"I mine the earth, content," it said,
"A hidden miner underfoot:
I know a rose is overhead."

BIRDS*

Richard H. Stoddard, a well-known American poet, in these verses gives us a pretty little fancy. It is a happy thought to liken the fleeting visions of the poet's brain to the birds that flit past the open cage, and yet the poet, even in the following lines has "caged" very daintily one of these fleeting fancies.

BIRDS are singing round my window,
Tunes the sweetest ever heard;
And I hang my cage there daily,
But I never catch a bird.

So with thoughts my brain is peopled,
And they sing there all day long;
But they will not fold their pinions
In the little cage of Song!

THE ELIXIR

George Herbert is one of the finest religious poets who have written in the English language. He came of a noble family, being born at Montgomery Castle, Wales, on April 3, 1593. He died on March 3, 1633, and his life was written by Izaak Walton. This is a good example of his poetry, and it is given in the quaint spelling of his time. "The Elixir" was a supposed magic stone that changed base metal into gold.

TEACH me, my God and King,
In all things Thee to see;
And what I do in anything,
To do it as for Thee.

Not rudely, as a beast,
To runne into an action;
But still to make Thee prepossest,
And give it his perfection.

A man that looks on glasse,
On it may stay his eye;
Or, if he pleaseth, through it passe,
And then the heaven espie.

All may of Thee partake:
Nothing can be so mean,
Which with his tincture (for Thy sake)
Will not grow bright and clean.

A servant with this clause
Makes drudgerie divine:
Who sweeps a room, as for Thy laws,
Makes that and th' action fine.

This is the famous stone
That turneth all to gold;
For that which God doth touch and own
Cannot for lesse be told.

LONDON, 1802

This famous sonnet by William Wordsworth was composed in London, as the title indicates, at a period when the outlook for England was somewhat doubtful, as Napoleon was lording it over Europe. The poet was impressed by the need of some great voice, like that of Milton's, to inspire the nation with patriotic fervor; but, fortunately, though no great poet arose, circumstances forced the British people to a supreme effort, and not many years later Napoleon was a prisoner of the British in lonely St. Helena; for British heroism had won the decisive battle of Waterloo.

MILTON! thou shouldst be living at this hour:
England hath need of thee; she is a fen
Of stagnant waters: altar, sword, and pen,
Fireside, the heroic wealth of hall and bower,
Have forfeited their ancient English dower
Of inward happiness. We are selfish men;
Oh! raise us up, return to us again;
And give us manners, virtue, freedom, power.
Thy soul was like a Star, and dwelt apart;
Thou hadst a voice whose sound was like the sea:
Pure as the naked heavens—majestic, free—
So didst thou travel on life's common way,
In cheerful godliness; and yet thy heart
The lowliest duties on herself didst lay.

TO THE LORD GENERAL CROMWELL

In this great sonnet Milton addresses Oliver Cromwell before he has been declared Protector of the Commonwealth. The poet rejoices in the victories of the Puritan arms, but reminds the great soldier that in the time of peace that is coming there are other victories to be won, and the foes of religious freedom still to be fought.

CROMWELL, our chief of men, who through a cloud
Not of war only, but detractions rude,
Guided by faith and matchless fortitude,
To peace and truth thy glorious way hast ploughed,
And on the neck of crowned fortune proud
Hast reared God's trophies, and His work pursued,
While Darwen stream with blood of Scots imbrued
And Dunbar field resounds thy praises loud,
And Worcester's laureate wreath. Yet much remains
To conquer still; peace hath her victories
No less renowned than war: new foes arise
Threatening to bind our souls with secular chains;
Help us to save free conscience from the paw
Of hireling wolves, whose gospel is their maw.

ABIDE WITH ME

There are few hymns in our language more popular throughout the churches than this. An interesting story attaches to the writing of it. The author was a well-known minister and hymn-writer—see page 1801—named H. F. Lyte, and he wrote these verses in the evening of the Sunday on which he preached his last sermon. It is thus a very real expression of the human heart leaning in its last hours of life to the Creator. For "Abide with Me" is not, as many suppose, an evening hymn, but a hymn of closing life, as it was the dying song of him who wrote it.

ABIDE with me! fast falls the eventide,
The darkness deepens: Lord, with me abide!
When other helpers fail, and comforts flee,
Help of the helpless, oh, abide with me!

Swift to its close ebbs out life's little day;
Earth's joys grow dim; its glories pass away;
Change and decay in all around I see:
O Thou, who changest not, abide with me!

Not a brief glance I beg, a passing word:
But as Thou dwell'st with Thy disciples, Lord—
Familiar, condescending, patient, free—
Come, not to sojourn, but abide, with me!

Come not in terrors, as the King of kings:
But kind and good, with healing in Thy wings;
Tears for all woes, a heart for every plea;
Come, Friend of sinners, and thus 'bide with me!

I need Thy presence every passing hour;
What but Thy grace can foil the tempter's power?
Who like Thyself my guide and stay can be?
Through cloud and sunshine, oh, abide with me!

I fear no foe, with Thee at hand to bless:
Ills have no weight, and tears no bitterness:
Where is Death's sting? Where, Grave, thy victory?
I triumph still, if Thou abide with me.

Hold then Thy cross before my closing eyes!
Shine through the gloom, and point me to the skies!
Heaven's morning breaks, and earth's vain shadows flee:
In life and death, O Lord, abide with me!

* From "Poems of Richard Henry Stoddard," copyright, 1880, by Charles Scribner's Sons.

INCIDENT OF THE FRENCH CAMP

In this poem Robert Browning relates a real event which happened in Napoleon's war with Austria in 1809. The only difference between the poet's account of the incident and the actual episode is that the hero was a man and not a boy.

YOU know we French stormed Ratisbon,
A mile or so away;
On a little mound, Napoleon,
Stood on our storming day;
With neck out-thrust, you fancy how,
Legs wide, arms locked behind,
As if to balance the prone brow
Oppressive with its mind.
Just as perhaps he mused " My plans
That soar to earth may fall,
Let once my army leader, Lannes,
Waver at yonder wall."
Out 'twixt the battery-smokes there flew
A rider, bound on bound
Full galloping; nor bridle drew
Until he reached the mound.
Then off there flung in smiling joy,
And held himself erect
By just his horse's mane, a boy;
You hardly could suspect—
So tight he kept his lips compressed,
Scarce any blood came through—
You looked twice ere you saw his breast
Was all but shot in two.
" Well," cried he, " Emperor, by God's grace
We've got you Ratisbon!
The Marshal's in the market-place,
And you'll be there anon
To see your flag-bird flap his vans
Where I, to heart's desire,
Perched him!" The chief's eye flashed; his plans
Soared up again like fire.
The chief's eye flashed; but presently
Softened itself, as sheathes
A film the mother-eagle's eye
When her bruised eaglet breathes;
" You're wounded!" " Nay," his soldier's pride
Touched to the quick, he said:
" I'm killed, Sire!" And his chief beside
Smiling the boy fell dead.

PEACE

Henry Vaughan was the name of a doctor who lived from 1622 to 1695 and wrote many poems of a religious character. This little poem of abiding faith in God is taken from his works.

MY soul, there is a country
Afar beyond the stars,
Where stands a winged sentry,
All skilful in the wars.
There, above noise and danger,
Sweet peace sits crowned with smiles,
And One born in a manger
Commands the beauteous files.
He is thy gracious Friend,
And (O my soul awake!)
Did in pure love descend,
To die here for thy sake.
If thou canst get but thither,
There grows the flower of peace—
The rose that cannot wither—
Thy fortress, and thy ease.
Leave, then, thy foolish ranges;
For none can thee secure,
But One who never changes—
Thy God, thy Life, thy Cure.

THE BUILDERS

Longfellow in this little poem seeks to remind us that in every action of our lives we are building the house of our future. That is to say, what we are doing well or ill **to-day, and what we did ill or well yesterday, will mean much in the days to come. So it behoves us, as it does all good builders, to see that everything we do is of our best.**

ALL are architects of fate;
Working in these walls of time:
Some with massive deeds and great,
Some with ornaments of rhyme.

Nothing useless is or low;
Each thing in its place is best;
And what seems but idle show
Strengthens and supports the rest.

For the structure that we raise
Time is with materials filled;
Our to-days and yesterdays
Are the blocks with which we build.

Truly shape and fashion these,
Leave no yawning gaps between;
Think not, because no man sees,
Such things will remain unseen.

JESUS BIDS US SHINE

The following has long been popular as a children's hymn, for which purpose its simple language makes it particularly suitable. The name of the writer is Emily H. Miller.

JESUS bids us shine
With a pure, clear light;
Like a little candle
Burning in the night;
In this world of darkness,
So we must shine—
You in your small corner,
And I in mine.

Jesus bids us shine,
First of all for Him;
Well He sees and knows it
If our light is dim.
He looks down from heaven
To see us shine—
You in your small corner,
And I in mine.

Jesus bids us shine,
Then, for all around;
Many kinds of darkness
In the world abound.
Sin and want and sorrow;
So we must shine—
You in your small corner,
And I in mine.

COMPOSED UPON WESTMINSTER BRIDGE

One of Wordsworth's finest sonnets, there are probably no lines about London more often quoted than these. It was one morning in the summer of 1802 that the poet, driving over Westminster Bridge on his way to Dover, was so struck with the grandeur of the scene, the great city still sleeping beneath the early sun, that the poem took shape in his mind, and he wrote the words as he traveled to Dover.

EARTH has not anything to show more fair:
Dull would he be of soul who could pass by
A sight so touching in its majesty:
This City now doth like a garment wear
The beauty of the morning: silent, bare,
Ships, towers, domes, theatres, and temples lie
Open unto the fields, and to the sky,
All bright and glittering in the smokeless air.
Never did sun more beautifully steep
In his first splendour valley, rock, or hill;
Ne'er saw I, never felt, a calm so deep!
The river glideth at his own sweet will:
Dear God! the very houses seem asleep;
And all that mighty heart is lying still!

LITTLE VERSES FOR VERY LITTLE PEOPLE

UNDER a toadstool
Crept a wee Elf,
Out of the rain,
To shelter himself.

Under the toadstool,
Sound asleep,
Sat a big Dormouse
All in a heap.

Trembled the wee Elf,
Frightened, and yet
Fearing to fly away
Lest he got wet.

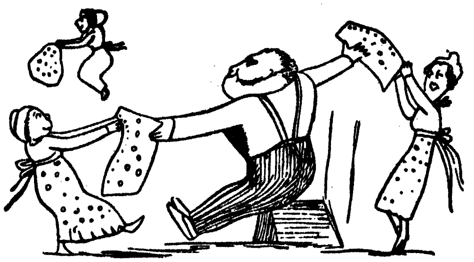
To the next shelter—
Maybe a mile !
Sudden the wee Elf
Smiled a wee smile.

Tugged till the toadstool
Toppled in two.
Holding it over him,
Gaily he flew.

Soon he was safe home,
Dry as could be.
Soon woke the Dormouse—
" Good gracious me !

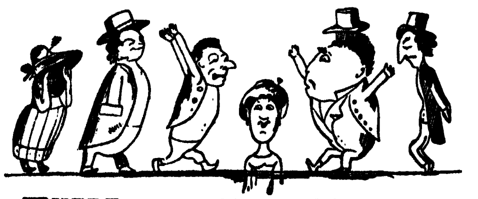
" Where is my toadstool ? "
Loud he lamented—
And that's how umbrellas
First were invented.

THE NONSENSE OF EDWARD LEAR



THERE was an old man in a pew,
  Whose waistcoat was spotted with blue;
 But he tore it in pieces,
 To give to his nieces,
That cheerful old man in a pew.

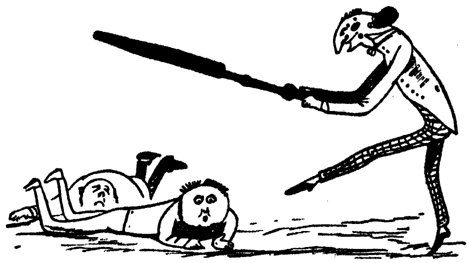
THERE was an old man of Aôsta,
  Who possessed a large cow, but he lost her;
 But they said, " Don't you see,
 She has rushed up a tree ?
You invidious old man of Aôsta ! "



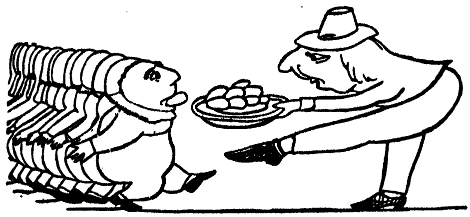
THERE was an old lady of Chertsey,
  Who made a remarkable curtsey;
 She twirled round and round,
 Till she sunk underground,
Which distressed all the people of Chertsey.

THERE was an old person of Rhodes,
  Who strongly objected to toads;
 He paid several cousins
 To catch them by dozens,
That futile old person of Rhodes.

THERE was a young lady of Portugal,
  Whose ideas were excessively nautical;
 She climbed up a tree,
 To examine the sea,
But declared she would never leave Portugal.



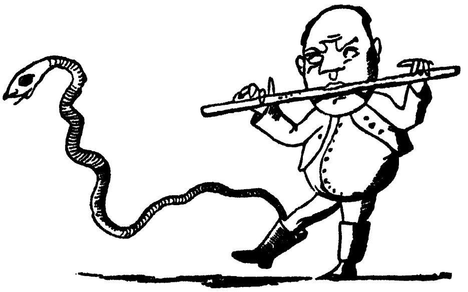
THERE was an old man with a poker,
  Who painted his face with red oker;
 When they said, " You're a guy ! "
 He made no reply,
But knocked them all down with his poker.



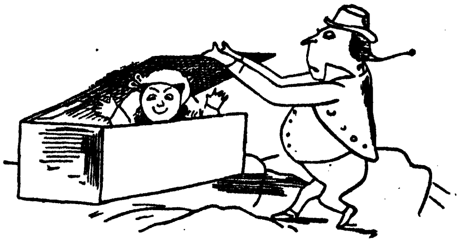
THERE was an old man of Apulia,
  Whose conduct was very peculiar;
 He fed twenty sons
 Upon nothing but buns,
That whimsical man of Apulia.

THERE was an old person of Basing,
  Whose presence of mind was amazing;
 He purchased a steed,
 Which he rode at full speed,
And escaped from the people of Basing.

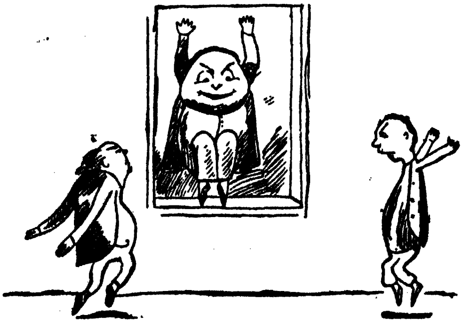
THERE was an old man in a boat,
  Who said, "I'm afloat! I'm afloat!"
When they said, "No, you ain't!"
  He was ready to faint,
That unhappy old man in a boat.



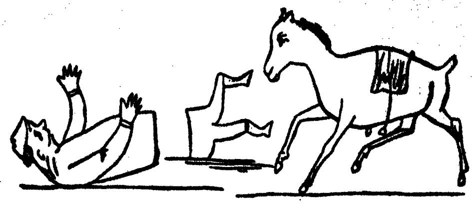
THERE was an old man with a flute,
  A sarpint ran into his boot;
But he played day and night,
  Till the sarpint took fright,
And avoided that man with a flute.



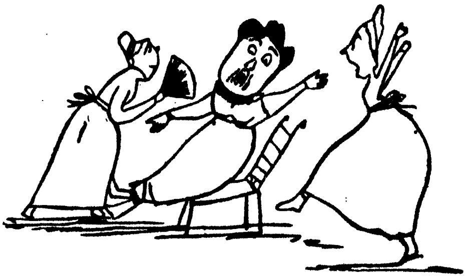
THERE was an old man on some rocks,
  Who shut his wife up in a box;
When she said, "Let me out,"
  He exclaimed, "Without doubt,
You will pass all your life in that box."



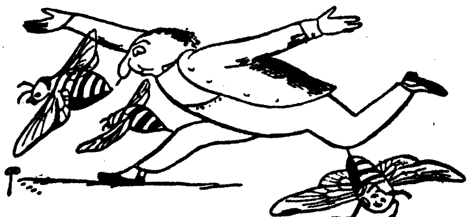
THERE was an old man at a casement,
  Who held up his hands in amazement;
When they said, "Sir, you'll fall!"
  He replied, "Not at all!"
That incipient old man at a casement.



THERE was an old man of Nepaul,
  From his horse had a terrible fall;
But, though split quite in two,
  By some very strong glue,
They mended that man of Nepaul.



THERE was a young lady of Russia,
  Who screamed so that no one could hush her;
Her screams were extreme,
  No one heard such a scream,
As was screamed by that lady of Russia.



THERE was an old person of Dover,
  Who rushed through a field ot blue clover;
But some very large bees
  Stung his nose and his knees,
So he very soon went back to Dover.

THERE was an old person of Chili,
  Whose conduct was painfully silly;
He sat on the stairs,
  Eating apples and pears,
That imprudent old person of Chili.

THE BEES

Moderately

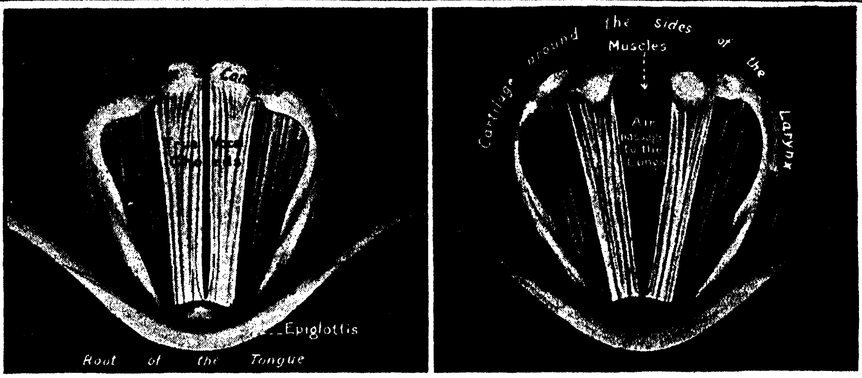
Music by permission of MESSRS. SCHOTT & Co. **Words by ALFRED P. GRAVES.**

2. Sum, sum, sum! bees to business come!
You this flow'ret, you this flower,
Drain of dew, for pollen scour!
Sum, sum, sum! bees to business come!

3. Sum, sum, sum! bees now cease your hum!
Hiveward with your spoil come sailing,
Sweets to store for our regaling!
Sum, sum, sum! bees now cease your hum!

4. Sum, sum, sum! bees about us hum!
When the Christmas-tree is lit up
Through its flowers you'll seem to flit up!
Sum, sum, sum! bees about us hum!

5. Sum, sum, sum! bees about us hum!
Then the tapers bright will show you
All the honey-cakes we owe you!
Sum, sum, sum! while for joy you hum!



In the first of these pictures, which shows the larynx, or voice-box, we see the vocal cords in position for producing a sound. The air is forced through the narrow slit, vibrating the cords. In the second we see the vocal cords at rest. The epiglottis covers the larynx when we are swallowing.

HEARING AND SPEAKING

PRECIOUS THINGS IN OUR LIVES THAT BEGAN IN FISHES

CONTINUED FROM 3918

THE inner ear would be quite sufficient to make the bone that contains it the most wonderful in the body. We know that that bone is the hardest in the body; and this is necessary not only because it forms part of the base of the skull and should be strong, but also, we suppose, because a hard bone conducts sound-waves better than a more loosely-built one.

We must understand that the important thing in hearing is for sound-waves somehow or other to get to the hair-cells. Much the best way is through the fine series of structures about which we read on page 3916; but though they are very useful, and though we cannot hear anything like so well without them, they are not necessary.

From the teeth, or from the bones of the head in general, sound-waves can be conducted—and, of course, are conducted, whenever we hear—which are conveyed very well by the dense bone that contains the inner ear, and so get to its hair-cells. Sound-waves reaching the ear in this way contribute to the keenness of our hearing, but, of course, they cannot compare for effectiveness with those that travel along the wonderful path made for the special purpose of hearing. But there is another reason why the bone that contains the inner ear is of very great importance and interest. It also contains another organ of a wholly distinct sense, which lies close beside the inner ear, and is, indeed, in more or less direct communication with it. For many years it was supposed that this organ was part of the inner ear, and was concerned with hearing. We now know that it has nothing to do with hearing.

The mistake was made more natural by the fact that one and the same nerve seems to run from the brain to both parts—as they were supposed to be—of the inner ear. In point of fact, what looks like one nerve, and is still called one nerve, is two wholly distinct nerves, as we can readily prove if we trace the course of the fibres towards the brain.

We find that the fibres which have come from the real inner ear all run to a certain part of the brain, the business of which is hearing. But we find that the fibres which have

come from this other organ all run to an entirely different part of the brain which has nothing to do with hearing at all. In fact, what we are here dealing with is the sense of balance, and it is probably more or less of an accident that its machinery happens to be such a close neighbor to that of the sense of hearing.

A LITTLE-KNOWN PART OF OUR BODY THAT HELPS US TO STAND

This sense of balance is, in a way, a sense that tells us about the outside world, like hearing or vision; because it *does* tell us where the outside world is in relation to our bodies. But it is quite unlike the senses we know so well, as it is not arranged to receive anything from the outside world at all, and so, unlike the eye or ear, it has no connection with the surface of the body. We may say that this is one of the senses which tell the brain about the body, rather than about the world outside the body.

Before we study the organ of this sense, we must notice, in the first place, that it is helped by other means. We do not entirely depend for our balance upon the organs of balance in the base of the skull, though we certainly cannot balance ourselves without their assistance. When we stand, for instance—and standing is a very much more difficult matter than we usually suppose—our power of balance is greatly helped by the feelings we get from the soles of our feet. If something is painted on to the soles of our feet so that the skin there can no longer feel, or in cases of illness which have the same result, we cannot stand so easily as we usually do.

But the sense of balance is also helped by the eyes. As long as the eyes are open, even a person who is not helped by the soles of his feet may balance himself; or, with his eyes shut, he may yet balance himself if he stands with his feet far apart; but if he puts his heels together, and shuts his eyes, he will probably topple over on the ground.

THE GREAT USE OF THE EYES IN BALANCING THE BODY

People, however, can stand with their heels together, and with their eyes shut, thus doing without the assistance of sight, if the organs of balance in the skull are all right, and if guidance is also coming to the brain from the soles of the feet, and also from the muscles and joints of the legs. If we set ourselves the task of balancing on a very narrow plank, or, still more difficult, on a tight-rope, then our eyes become more useful, and, unless we are very skilful indeed, they are quite necessary. Everyone knows how the tight-rope walker keeps his eyes steadily fixed on a certain point, and so greatly helps himself. If he is very skilful, he may walk on the tight-rope even though he bandages his eyes; but this is far more difficult. However, the eyes and the feelings from the skin and joints and muscles are all unimportant compared with the guidance we get from the special organs of balance, and no one was ever yet able to stand or walk on the ground, much less on a tight-rope, in whom these organs were not working properly. Now we must learn of what they consist.

In the hard bone that contains the inner ear, and close to the inner ear—on each side of the head, of course—we find this organ of balance, of which a picture is given on page 3912. It consists of three tiny tubes, in shape like half a circle.

THE SIX LITTLE TUBES WHICH TELL THE BRAIN OUR MOVEMENTS

The proper name for a half-circle is a semi-circle, just as half a tone is a semitone, and the corresponding adjective is, of course, semi-circular; not a difficult word if we know how it is made up. The proper name for these tubes, then, is the *semi-circular canals,* and of these the head of every human being and of all the higher animals contains six, three on each side. They are all filled with fluid.

Just as the nerve of vision runs to the eye and the nerve of hearing to the ear, so the nerve of balance runs to the semicircular canals. The ends of the nerve—that is to say, the ends of the countless nerve-fibres which make the nerve—lie close to the fluid that fills the canals, and if that fluid moves, or if the pressure on it changes in any direction, the nerve-fibres know about it.

Now let us look at an ordinary child's block, which we call a cube. If we want to measure it, we find that it can be measured in three directions—from top to bottom, from side to side, and from back to front. We may pick up any solid thing, and we find the same is true of it. We may want to measure a room, and we find again that the same is true; we must measure the floor in both

directions, and we must also measure the height of one of the walls.

In general terms, space has three directions—or dimensions, to give the usual word—and when we move our head it must move in one or more of those three directions. We may nod our head, or we may shake our head, or we may raise it up and down. All the possible movements of the head are either in one of these directions or in a combination of two or all three of them. Now, the business of the organ of balance is to acquaint the brain with every possible movement of the head, and it must therefore be so constructed that all possible movements shall duly register themselves in it.

This is done in the most exquisite way by the provision of three canals on each side of the head, these three canals being arranged in correspondence with the three dimensions, or directions, of space. One canal lies on its side, so to speak, or is horizontal; and the other two are upright, but at right angles to each other. As there is an organ of balance on each side of the head, we may think of the canals in pairs, and there is no doubt that they act in pairs. For instance, the horizontal canal on each side of the head acts with its fellow when we shake the head, or when we spin round, as we do in dancing.

THE MOVING FLUID IN THE SIX LITTLE CANALS IN OUR HEADS

The consequence of this arrangement is that every possible movement of the head has a strictly corresponding effect upon the fluid inside one or more pairs of these six canals, and the centre of balance in the brain is informed. This centre of balance probably exists in the cerebellum, or little brain. Sometimes we have an illness in which the organ of balance is thrown out of action, and just as a person whose eyes are injured cannot see, so those in whom the organs of balance are injured cannot balance. They suffer from persistent giddiness.

It has also been proved that where the injury affects only certain of the canals, the giddiness corresponds to the direction of the particular canal or canals in question. If it is only the horizontal canals that are thrown out of action, then we shall be all right so far as nodding the head is concerned, but directly we start shaking it, we shall become giddy, and, if we do not receive support, topple over.

The history of the semi-circular canals is deeply interesting. The lowest kind of creature with a backbone, as we know, is the fish, and we find in it one or more of these canals. Now, the fish is very clever at balancing itself, and shows no signs of giddiness; but probably we can explain why the fish manages so well without so many semi-circular canals, if we remember how great the pressure of water is upon the surface of the fish, and therefore how much more information the fish must get from its skin than we are able to get from ours.

HOW BIRDS ARE ABLE TO FLY WITHOUT TUMBLING OVER

As we ascend the scale of backboned animals, we find increasing development of these semi-circular canals, though they do not all appear at once. If our statements as to their use are correct, we should expect to find them most beautifully and perfectly developed in birds, which could not succeed in flying without a perfect sense of balance. In flying, the bird gains little from the feet and legs, as we do in the very much simpler business of standing or walking; and therefore its need of special organs of balance is all the greater.

So we find the semi-circular canals at their very best in birds, and we know also that, just as in our own case, if the canals are thrown out of action, the bird's power of balance is destroyed, and in flying it will make mistakes and show peculiarities corresponding to the particular defect in its organ of balance. It is probable that in this way we can explain the peculiarity of what are called "tumbler" pigeons.

It used to be thought, before these newer facts were discovered, that the semi-circular canals had something to do with hearing; and we can understand how natural this idea was, seeing that the canals look as if they were part of the inner ear, and their nerve looks as if it were a part of the nerve of hearing.

THE LITTLE ORGANS IN OUR EARS THAT HAVE NOTHING TO DO WITH HEARING

The idea used to be that probably we somehow judge of the direction of sound by means of these semi-circular canals.

No one could look at their singular arrangement without feeling that their business had something to do with

direction. But we now know that their business is with the direction in which the head moves, and not with the direction of sound. It is much more important to know what the head is doing than to know where sound comes from, and, in any case, by having external ears that can be moved, a creature can easily enough judge of the direction of sound without any special machinery inside its head. If we human beings are not so well off in this respect, it is because we have lost the power of moving our outer ears like the animals.

THE FISH'S GILLS, UPON WHICH MANY PRECIOUS STRUCTURES ARE BUILT UP

We have lost this power that the animals have, but we have gained many things that the animals have not. In the very lowest vertebrate animals, such as the simplest fishes, and also in the higher fishes, too, we find, instead of lungs, what are called gills. To these the blood runs, as it runs to our lungs, and in them it comes in close relation with the oxygen dissolved in the water, just as in our lungs the blood comes in close relation to the oxygen of the air. The gills have to be supported on something, and so we find in the fish five gill-arches, with slits between them called gill-slits.

Gills did not develop into lungs, but lungs developed from a quite different organ, called the swim-bladder, of the fish. Now, we might suppose that when backboned animals left the water and began to breathe air, no use was found for the gill-slits and gill-arches, as the gills were not made into lungs. But some of the most wonderful and precious structures of the higher backboned animals have been developed from the gill-slits and the gill-arches.

HOW THE SWIM-BLADDER OF THE FISH BECAME THE LUNG OF THE ANIMAL

We can never tell to what uses Nature will turn a thing, and the history of life upon this earth proves over and over again that organs which would appear to have lost all their use, and of which nothing could be made, may be turned to new and utterly different purposes. According to some scientists Nature took the swim-bladder, which used to be filled with air, and helped the fish to swim at the level it liked, and made it into a lung, when the creature no longer swam under the surface at all.

With the gill-arches she has done things much more wonderful than this. In the first cleft of the gill-arches the whole of the ear was developed. As we have learned, the ear is more than an organ of hearing. It is an organ of balance as well. Not only the little bones, through the aid of which we hear, but also the wonderful semicircular canals have grown from this simple structure. There is nothing more wonderful than this in the whole story of the human body.

But there is more of the strange story. Scientists who have studied the human body tell us that much of the structure of our faces has also grown out of the gill-arches. The bone at the root of the tongue and all the structure which enables us to speak are developments. All of the voice-box, or larynx with its rings of cartilage, has grown out of the apparatus which made it possible for a fish to breathe. The gill-arches were used entirely to enable a fish to get air in water. The use of the larynx requires air, to be sure, but in a different way.

THE VOICE-BOX, AND THE SERIOUS PART IT PLAYS IN OUR LIVES

Now, instead of going on to study another sense at this point, it is much better, for two very good reasons, that we should go on to study the larynx. First, we should do this because then we shall be studying together the various organs that have been developed in the higher animals from the gill-arches of the fish; and, secondly, we should do so because it is well to study the means by which we produce sounds, after studying the means by which we hear them.

We all know something, at least, about the larynx, because we have all seen the front part of it pushing the skin forward and sometimes moving up and down. There is a foolish notion that this is the apple which Adam swallowed, and which stuck in his throat, and so it is sometimes called Adam's apple. A larynx, or voice-box, similar to ours is to be found in all the higher animals, and, as we know, it is simply a stringed musical instrument. In the case of the birds, many of which have such beautiful voices, there is besides this stringed instrument another, which is practically an organ-pipe. But, in all its forms, and whether with or without this organ-pipe, the larynx is evolved from one of the gill-arches of the fish. This voice-

box, of course, is not only concerned with speaking and singing; it has important duties to perform every moment of our lives, because it is the channel of the breath of life. Further, owing to the manner in which the lungs have been developed in long-past ages, it has so occurred that the opening from the throat to the voice-box lies in front of the opening from the throat to the gullet.

Only the study of the way in which living things have developed one from another can enable us to see any meaning in this arrangement, which, as we know, makes it necessary for everything we swallow, whether liquid or solid, to be thrown over the opening to the larynx without entering it. There is thus placed upon the larynx another duty besides that of producing sound, and that of attending to our breathing, for it has to protect the air-passages every time we swallow. This organ is made of pieces of what is called *cartilage*. Our ordinary name for cartilage is gristle, and we may describe it as something which is half-way towards bone.

THE NARROW CHANNEL THROUGH WHICH PASSES ALL THE BREATH OF LIFE

In old age the cartilages of the larynx get to be not exactly bony, but more chalky and rigid than they are in youth; and this, probably, is one of the reasons why most people with sensitive ears can readily distinguish a young voice from an old voice.

The business of the larynx is to support and control the action of two tiny cords or strings called the *vocal cords*; that is to say, the voice cords. The picture on page 1648 shows what the vocal cords look like when they are seen from above by means of a bright little mirror held at the back of the throat. We see that the vocal cords have a free edge towards the middle, and that from it they pass outwards to the sides of the larynx.

All the air by which we live passes through the narrow space between the vocal cords. The arrangements by which they can be put together or separated are quite simple. They part every time we breathe in, and when we choke and cannot breathe in, it is because the vocal cords are not parting as they should. But if the cords are to produce voice, they must be able to do much more than this. It must be possible to hold them tightly stretched, so that when air is forced against them they will vibrate. Nor is this all, for it must be possible to stretch them in different degrees. As we shall learn when we come to study sound, the pitch—the shrillness or the lowness—of a musical note produced by anything trembling depends upon a number of things, such as its weight, its length, and its tightness.

THE WONDERFUL MUSICAL INSTRUMENT WITH ONE STRING

Now, in the case of a piano, when we want to produce notes of different pitch, we have a number of strings of different lengths laid side by side, so that we can strike the one that gives out the required note. Also, we can have some of them made of much heavier material than others. In the case of the violin, it is possible to have only very few strings, but we can produce all the notes we want by stopping the strings with our fingers, so that the length of string that is free to vibrate can be altered as we please; and the strings are made of different weight and thickness.

But in the larynx there are only two strings, and these always act together, it being impossible to produce voice with one of them; moreover, they are of the same weight and length. Outside the human body, a musical instrument that had practically only one string, and that could not be stopped at different points like a violin string, would not be able to produce much variety of pitch. The only possible way of getting any variety would be to have some means of varying its tightness. It is probably correct to say that there is no material other than that made by life that can be tightened in such different degrees as the needs of music demand, without permanent injury to the strings.

THE MARVELOUS POWER THAT A GOOD SINGER HAS OVER THE HUMAN VOICE

But though our vocal cords have only the one possibility of varying pitch, due to the fact that they can be tightened in different degree, with this one means they triumph. A good singer can produce all the notes in a range of two octaves, and many singers are able to exceed this compass considerably. Outside the body there is no parallel to this. It is interesting, therefore, to know of what the vocal cords are made,

so that they can stand such varying degrees of tightness, within a few seconds, without injury. They are simply made of fibres of what we call elastic tissue, such as is found in various parts of the body wherever it is needed. But an ordinary piece of elastic is rubbish compared with the elastic tissue made by the body.

HOW THE VOCAL CORDS ARE TIGHTENED TO PRODUCE DIFFERENT SOUNDS

The next question is—How is their tightness varied? In front, just behind the part of the voice-box that we see from outside, the cords are fixed to the largest cartilage of the larynx, but, behind, each of them is fixed to a tiny little knob of cartilage which is delicately jointed to the part that it rests on, so that it can be tilted in several directions.

What really happens when we sing is that these little knobs of cartilage are tilted backwards so that the cords are made tighter when our voice ascends in pitch, and are tilted forwards so that the cords are made slacker when our voice falls in pitch. This is easy to say, but the picture on page 3997 will show what the cords are like; and the muscles which do all this work are tiny little shreds.

When a singer is producing one of his highest notes, the cords have to be so tight as to vibrate four times as often in every second as when he is producing one of his lowest notes. Thus, in the whole range of Nature, there is scarcely anything more perfectly delicate than the control which a singer has over this tiny little machine to produce such results.

WHY THE HUMAN VOICE IS MUCH MORE MARVELOUS THAN A PIANO

Nor must we suppose that the singer is merely limited to the number of notes that there are on the piano in two octaves. Pianos vary in pitch, as we know, and a singer can tune his voice to the pitch of any piano he sings with. Skilful singers can produce several tones, even as many as eleven, between two notes that are next to each other on the piano.

As we have said, all this depends on the tightness of the cords, and the tightness depends on the strength with which certain tiny slips of muscle pull upon the cartilages to which the cords are attached; and that depends upon the force of the nerve-current sent to the nerves through these muscles from certain nerve-cells in the brain. The place, therefore, where the unrivaled delicacy of this machine really exists is the nerve-centre in the brain.

As everyone knows who has tried to read a song of which he was not sure, or as anyone may observe who watches a child learning to sing, it is one thing to have all the machinery for producing a note that is easily within the range of our voice, and it is quite another thing to be able to produce that note when we wish. There are two stages of difficulty here, and the second is marvelous beyond anything we have yet described. The first of these is where we simply imitate a note we hear.

This is quite wonderful enough, for it means the beautiful working together of the cells in the hearing centre of the brain with the cells of that part of the brain which gives orders to the muscles of the voice-box.

THE MYSTERY OF THE WRITING AND SINGING OF MUSIC

But now take the second case, where a singer sings aloud the notes of a piece of music that he has never seen before. What is it that he imitates now? What is it that guides him? We can only say that the singer imitates, or realizes, his idea of a certain sound that he has in his mind, but what and where the idea really is, and how the singer can do what he does, no one can say, for we are here in the realm of the mind—the most mysterious of all things, and it baffles us utterly.

Lastly, we have the case of the composer sitting down with a pencil and a sheet of paper, and creating music "out of his head" for other people to sing and play. Some of the greatest music ever written—music which has made miserable people happy, and cowardly people brave, and frivolous people solemn, and will do so to the end of time—was written by a man named Beethoven many years after he had become stone-deaf. He never heard a note of the greatest and most wonderful part of the music that he wrote; and yet, in his mind's ear, he heard it better than anyone has ever heard it since, or he could not have created it.

THE NEXT PART OF THIS IS ON PAGE 4093.

We should hardly think that there is any connection between this picture and a piece of rope. Yet here we see rope growing in the shape of hemp. This kind of hemp is called Sisal hemp, because it grows at Sisal, in Yucatan. There are miles and miles of hemp plantations like this in Mexico.

A PIECE OF ROPE

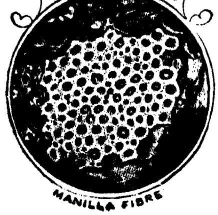
CONTINUED FROM 3854

THERE is a baby rope in the cages of most song-birds. It is in the seed-pot. If we look we shall find only seed: canary-seed, rape-seed, mustard-seed, perhaps, and hemp-seed. It is the hemp-seed that is the baby rope.

If we were to sow some of those seeds, we should find that they would grow, in rich, damp soil, fed by the hot sun, into great plants. To see the best American hemp we must go to some parts of Kentucky, or better yet, to California. But foreign hemp is to be found under the blazing sun of the tropics, and in the cold lands of Northern Russia.

It is the stalk of the plant that we need for our ropes and strings and twines. Upon it grows a bark made up of fibres. If we want fine fibre to make cloth, we pluck up the plant as soon as it has flowered. If we want coarser fibre for the making of sails, we let it grow a little longer. If we want the coarsest of all—for strings, and cords, and ropes—we let the hemp grow as long as it will.

So much for the baby rope which we see in the cage-bird's seed-pot. But there are various other things which make ropes. Those brown ropes which are never tarred, and are so much lighter than hempen ropes, are made from the husk of the cocoanut, and are called coir ropes. Then there is a fine rope, used in the driving of machinery, made of cotton. But the most wonderful rope is made from a plant named the *abaca*, and more generally called Manila hemp. It grows in the Philippine Islands, and the islanders receive about $20,000,000 a year from it. The natives split the leaf-stalks into long strips, beat them with clubs, then wash and dry them.

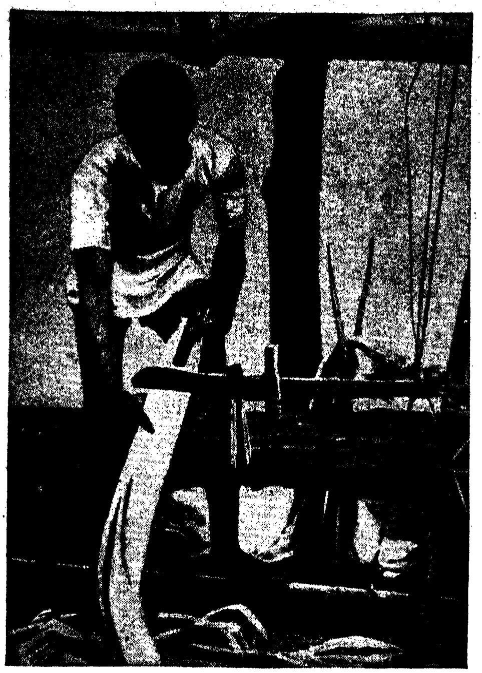


MANILLA FIBRE

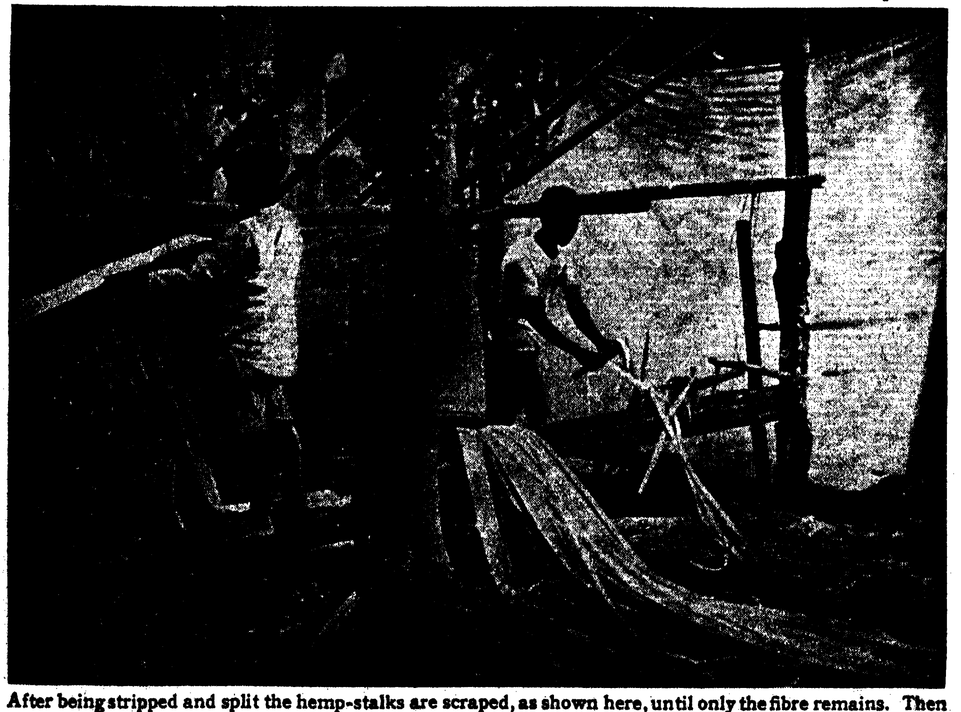
The making of rope is now an elaborate process in which very wonderful machines are used. In making rope by hand, the fibre of the hemp is separated from the stalk by long soaking in water. Then the fibre has to be divided, and the short lengths removed. The long pieces are laid parallel to each other, and the ends are attached to a revolving hook. The workman winds some hemp round his waist, and walks backwards, twisting the pieces, fitting them into the strand that he is making, and shaping them properly. All the time the hook to which the end is fastened continues to spin round. Very little rope is made in this way, as machinery, of course, does this very rapidly.

GETTING THE HEMP READY TO MAKE ROPE

Manila hemp, which grows in the Philippine Islands, differs very much from the Sisal hemp, shown on page 4003. Sisal hemp is something like mammoth grass, but Manila hemp is taller and looks like a palm.



The leaf-stalks of the hemp are stripped from the trunk, and then the natives of the Philippines split the stems into lengths two or three inches wide, using a kind of bamboo knife, as seen in this picture.



After being stripped and split the hemp-stalks are scraped, as shown here, until only the fibre remains. Then this fibre is washed and dried, and packed into bales ready to be sent all over the world. Two men working all day can prepare 25 pounds of hemp, and it takes 3,000 trees to produce a ton, worth from $150 up.

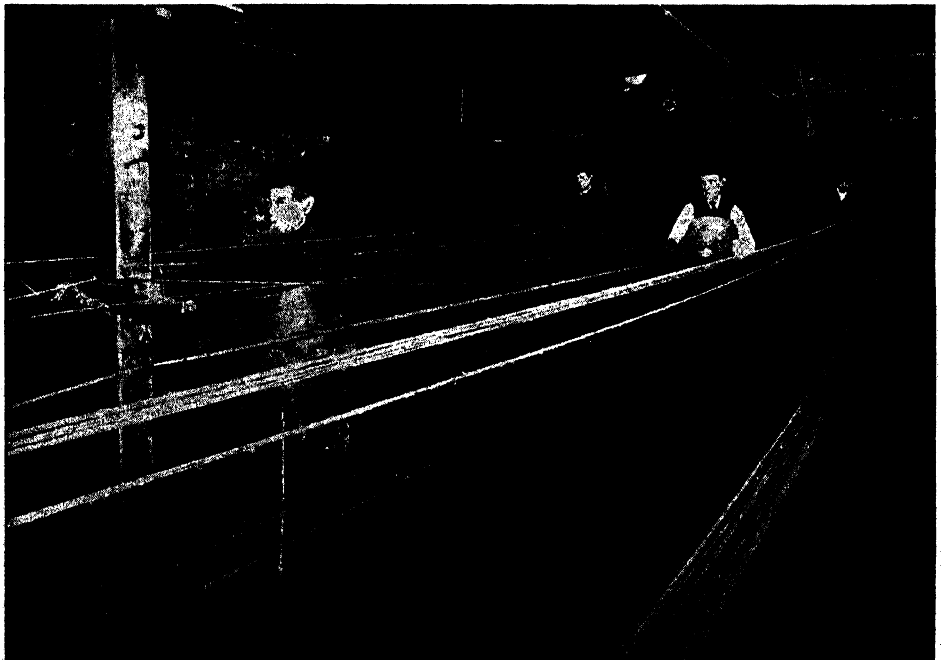
MAKING ROPE FROM COCOANUT SHELLS

A very elastic rope is made from the outer covering of the cocoanut, which, as we know, is quite fibrous, or stringy. The husks are first gathered in heaps, as shown in this picture, and then soaked for months in water to make the fibres soft. The cocoanut fibre is called coir, which is from an Indian word meaning rope.

Coir rope is made in India and Ceylon with simple machinery. A number of natives stand, as seen here, each with a bundle of prepared coir under the left arm. The ends are fastened to a wheel, which a man turns, and as more and more fibre is added, the rope grows longer and longer. Coir ropes are very strong.

THE OLD WAY OF MAKING ROPE BY HAND

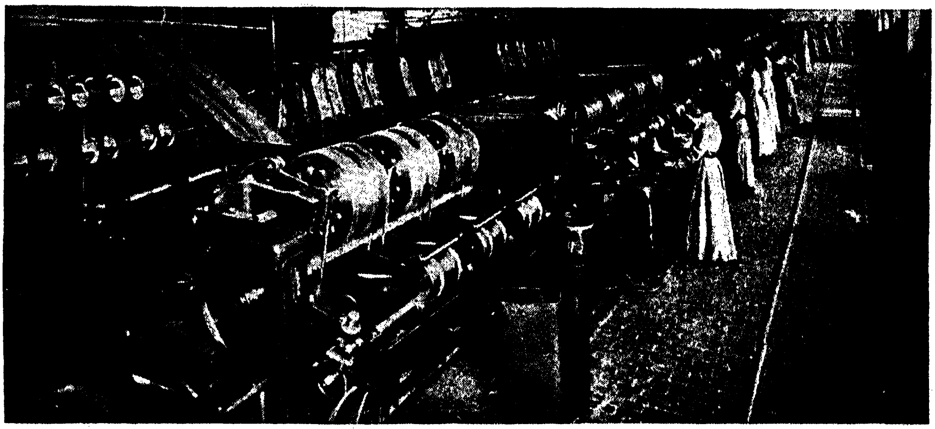
The old-fashioned way of making rope by hand is dying out, although it still exists in some small rope-works. Here we see men combing out hemp by drawing it through a series of long spikes fixed into boards that look like inverted rakes. The men work quickly, but it takes a long time to prepare a ton of hemp by hand.



Here we have an old-fashioned rope-walk ; but there are not many places in America to-day where we can see a scene like this. The method is very much like that shown on page 4005, each fibre being added by hand, the workers becoming wonderfully expert and quick in making ropes of the same thickness from end to end.

THE MODERN WAY OF MAKING ROPE

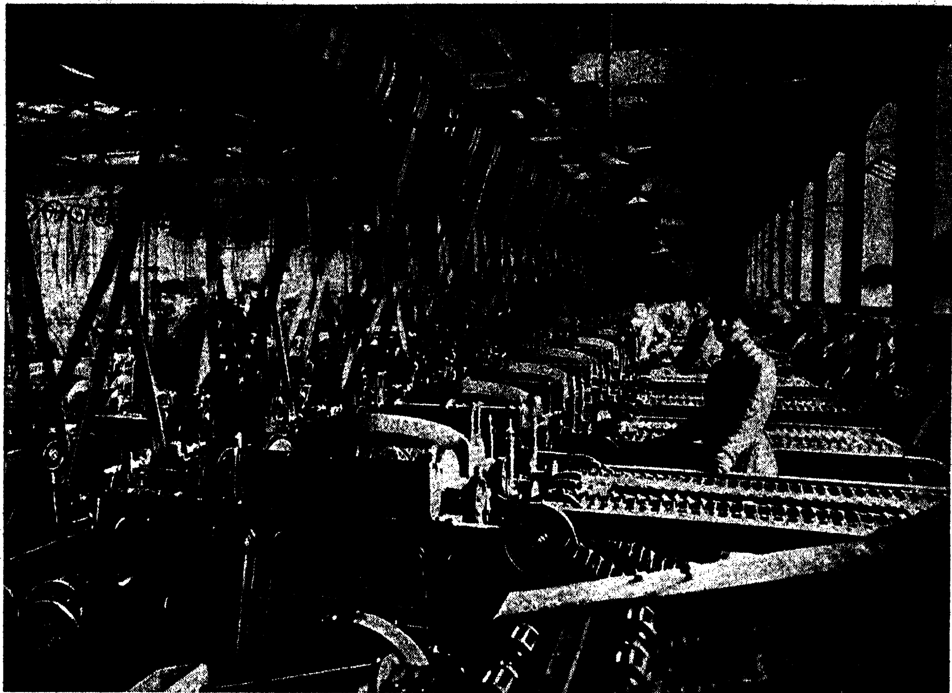
This picture shows the first process in making rope in a modern factory. The hemp is taken from the bales and fed into a machine called a spreader, which spreads out the hemp so that it may be easily dealt with.



After being spread, as in the picture above, the hemp goes through other processes, and is then combed, or drawn, out by machines like these. It runs into iron cases, and is wheeled away to the spinning-room.

Although hemp for the strongest ropes comes from the Philippines, we receive a great deal from Russia and Italy. This is true hemp ; for Manila hemp is not really hemp at all, but is from a different kind of plant altogether. Here we see women preparing Russian and Italian hemp. All machinery used in rope-making is elaborate, and works rapidly. Each machine in the top picture prepares 10,000 pounds of Manila a day.

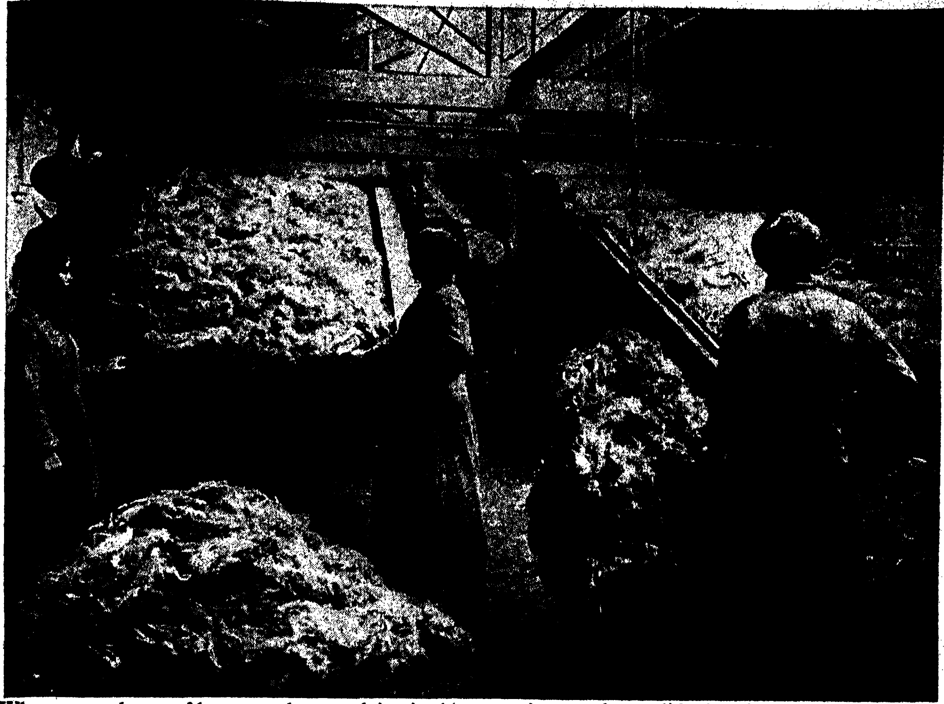
SPINNING THE HEMP INTO ROPE & TWINE



In this room twine for fishing-nets is being made, and there are 150 spinning machines at work. If we went into the room, we should be deafened by the whirring of the wheels ; but the workers get used to it.

Here we see Russian and Italian hemp being spun into rope. More than 100 years ago, Dr. Edmund Cartwright, who invented the power-loom for cotton-weaving, made a rope-spinning machine which he called a cordelier, and it is on this that the magnificent modern machinery for rope-making is based. Cartwright received $50,000 from Parliament for his inventions, which had added to the prosperity of the British nation.

COMBING OUT THE TANGLED HEMP



When we see heaps of hemp, such as are lying in this room, it seems impossible that the tangled mass could ever be unraveled. But by passing it through a machine called a carding machine, it comes out quite clear.

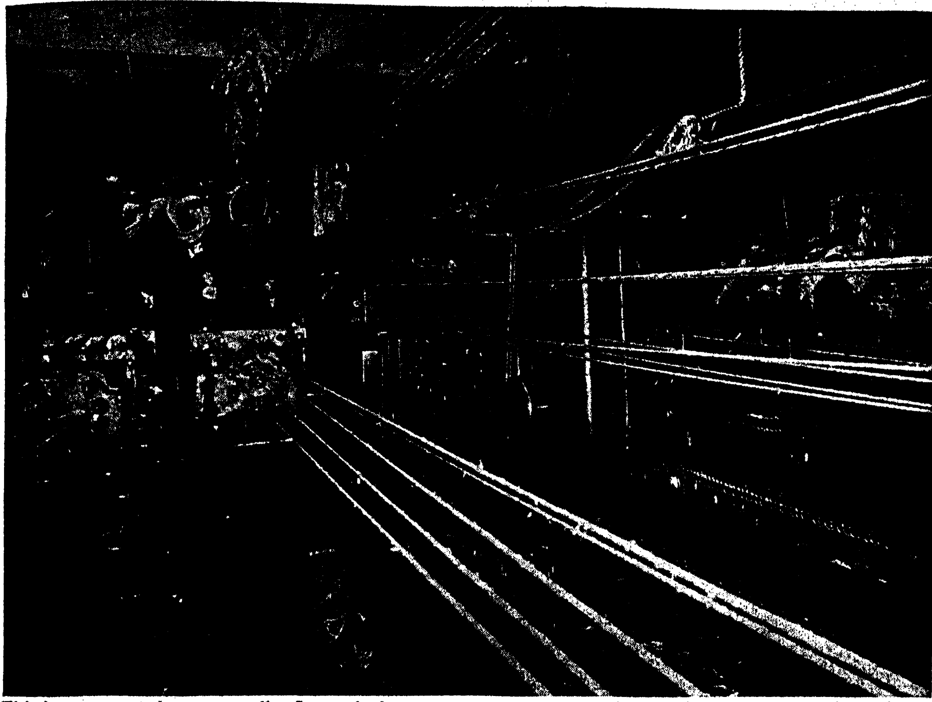
The coarser parts of hemp are called tow, and these are separated from the finer threads by a process known as hackling, the hemp being placed in a machine that has two endless bands studded with spikes. Here we see the tow being combed out in the drawing-room ready for spinning. The word tow simply means fibre.

WINDING & STORING THE TARRED YARN

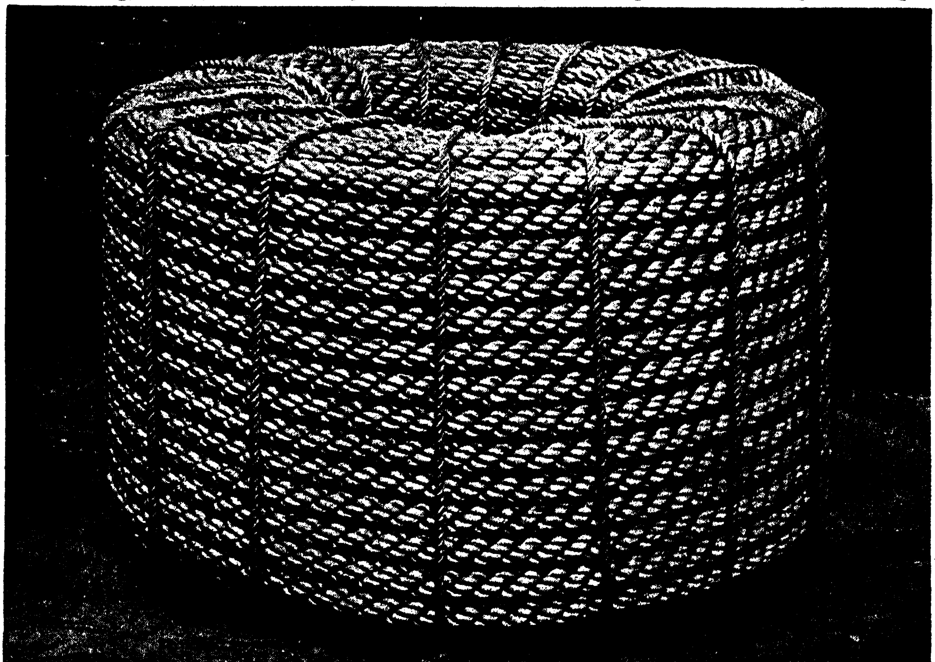
A great quantity of yarn, or hemp fibre, is tarred ready to be made into tarred rope; and in this store we see 150 tons, or 336,000 pounds, of the tarred yarn waiting to be wound on to spools, or reels.

This is how the tarred yarn is wound on to huge spools before being spun into a rope. In the foreground we see the full spools, to the left of the post are some spools just ready to be lifted from the winding machine, and on the right are some empty spools just being filled. The spools are wound twelve at a time.

THE ROPE FINISHED AND READY FOR USE



This is a present-day rope walk. Instead of one or two men walking the length of the alley with the hemp in their hands, elaborate rope-making machines run on rails; and in the rope-ground shown here, which is 1,200 feet long, as many as 18 tons of rope can be made in a day. The length varies according to the weight.

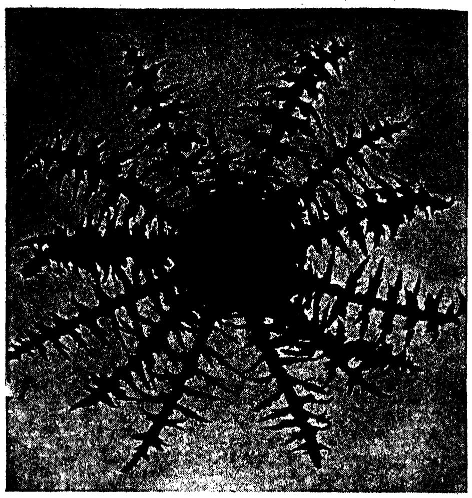


Here we see the finished rope. Apart from the rope we make in America for our own use we send abroad a large quantity of rope and string every year. This if joined would go round the world many times. One of the longest manila ropes ever made in one piece was over eleven miles long and cost nearly $12,500.

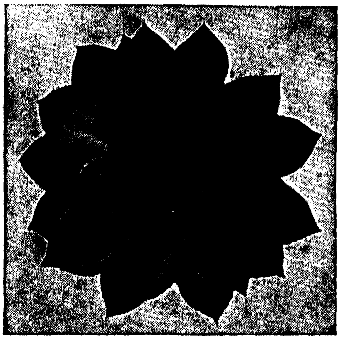
THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 4143.

THE PLANT AS A PATTERN-MAKER

THE LEAF ARRANGEMENT OF WOOD-SPURGE

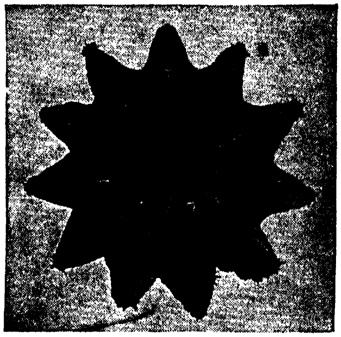


A PRETTY STAR-PATTERN OF THISTLE LEAVES

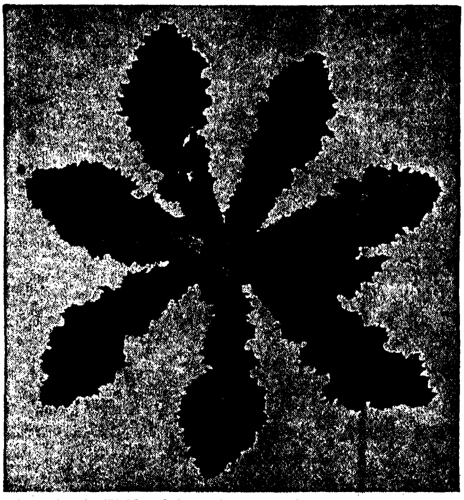


THE HOUSE-LEEK AS A ROSETTE

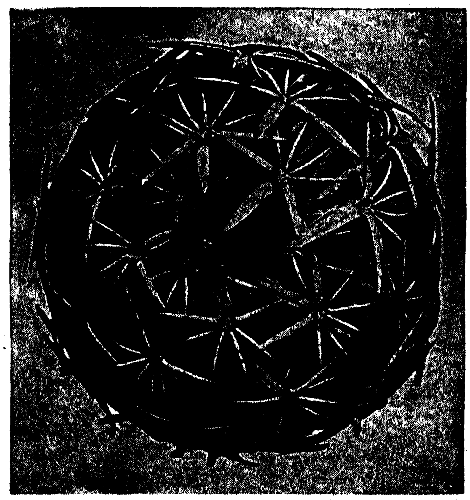
HAIRS ON A CACTUS



THE SEA-URCHIN CACTUS

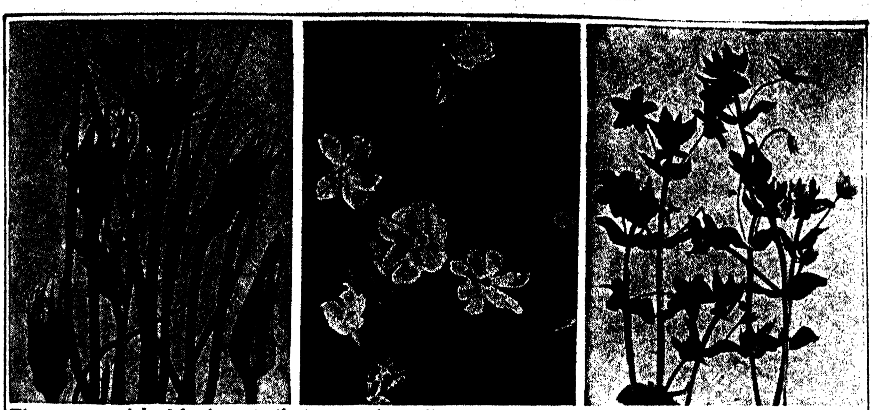


SOW-THISTLE'S LEAVES ARRANGED AS A STAR



A CACTUS STUDDED WITH PRICKLY STARS

We know what beautiful and varied designs are traced by Nature when she is making crystals like snow-flakes, and forming some of the creatures that live in the sea, like anemones and starfish, as we see on page 2407. But it is not only in the animal and mineral kingdoms that Nature is a pattern-maker. Many plants, as they grow, form regular designs with their leaves, and here we see striking vegetable stars and rosettes.



Flowers are visited by insects that carry the pollen, and according to the habits of the insect that visits it, a flower opens early or late. On the left we see goat's-beard, and on the right, scarlet pimpernel, that open early in the morning; and in the middle, white campion, that opens at evening.

THE HABITS OF FLOWERS

CONTINUED FROM 3952

WE know that plants differ in their liking for certain kinds of soils, as well as in choice of locality. Further, they often show a strong preference for either dry or wet ground; that is due to their degree of thirst, that, in turn, may be said to depend upon the thickness of their skins. The plants and trees we call evergreens are not thirsty because their leaves have hard, polished skins which do not allow the water in the plant to evaporate.

The less quickly the water is lost by the leaves the less work the roots have to do in sucking up moisture from the earth; therefore, of succeeding crops of plants which have been forced to grow in dry localities, those with the toughest skins have survived, and gradually each kind becomes perfectly protected as to foliage, and sometimes as to stems, against this loss of water, thus being comfortable where thinner-leaved plants would soon perish. That is why the cactus and the stonecrops can flourish on the driest, hottest, and stoniest soils.

It also follows that if we take the plants that grow in any place, and closely look at the different kinds found there, we shall find that they all agree pretty much in the structure of their leaves and stems from this point of view. If we climb a sunny hillside to gather flowers, we shall get spotted boneset, butterfly weed, and columbine, or white or golden daisies. Now, if we gather a bunch of these to carry home, they will not wither in our hands. But if we go along the riverside and gather meadow-sweet, forget-me-not, or fringed gentian, we shall find them all hanging their heads when we get home, and they may not revive when we put them in water.

If the seeds of the waterside plants are carried to the heath, or those of the heath plants are taken to the waterside, they may sprout, but they will never become full-sized plants, because they are not fitted for growth under such conditions. When we have learned that a certain kind of plant grows by the river, or in a marsh, we shall never expect to find it growing on sandy or rocky soil. And so we shall find that we can safely describe a plant as a rock plant, a hedgerow plant, a woodland plant, a waterside plant, a field plant, or a plant of some other dwelling-place.

When we come to read books on botany we shall find the special

haunt of a plant spoken of as its *habitat*; but if we remember that habitat means simply the place the plant inhabits—its dwelling-place—the word will not be a hard one.

All plants have their proper flowering time, and they are so precise that we may go out to find their flowers at the usual season and be sure to find them; that is to say, in any year when the weather is what we have a right to expect about that date. In some years the spring is late because the cold of winter has continued much longer than is usual. In such a year the spring flowers will also be late, for they go by seasons rather than by days of the month. They put out their flower-buds and open them when the weather is most suitable for their purpose.

But what we should like to learn is *how* the plants know when is the right time. How do the snowdrops and crocus bulbs buried in the ground know when the frost has gone? How does the almond-tree get its beautiful pink flowers out before its leaves are seen? How does the coltsfoot, that has not a leaf above ground, get word that the time has come to send up its yellow flower-heads? They do not know beforehand exactly when that time will be, but they know it will come, and that they must be ready for it.

HOW THE PLANTS WAIT FOR THE SUN BEFORE PEEPING OUT OF THE GROUND

And at the end of the autumn the snowdrop and crocus fit themselves out with a new set of roots, and their flower-buds and leaves having already been formed, though still very tiny in size and hidden right in the heart of the bulb, they set to work piercing the earth with their leaves. But before they reach the surface they find it is very cold—perhaps the top soil is frozen hard—and they rest. Then, when the thaw comes, the warm spring rain soaks down through the soil, and the plants know they may safely break through the surface.

There may come a change, and for some days, or even weeks, only the tips of the leaves show. But when the mild weather has really set in, the leaves are rapidly enlarged, the flower-buds are pushed up, and a very little sunshine will cause them to open out.

We must not imagine that the plant forms its flower-buds only a short time before they open. With garden *annuals*, the seeds of which we know are not sown until March or April, there cannot be any getting ready much in advance of the flowering time, but with bulbous plants and spring-flowering trees and shrubs the flowers in their buds were all formed by the autumn before.

THE WONDER OF THE BUDS IN WHICH THE TINY FLOWERS ARE HOUSED

When we go gathering wood-nuts in the autumn we can see pairs of hard, grey tassels hanging from the twigs. These are the lamb's-tails that will be long, soft, and yellow in the spring. While we are picking ripe apples from the tree we can tell which of the buds are leaf-buds and which are flower-buds, by the latter being much more plump than the former. When hyacinth bulbs are bought in the autumn for planting in the garden, if we look into the hole at the top we can see that the tiny flower-buds have already formed.

What seems more wonderful than plants being affected by the seasons, is the way they know the time of day. We have day flowers and evening flowers; but the day flowers do not all open early in the morning, neither do they all remain open until the sun sets. The morning glory, which is a summer flower, opens very early in the morning, and is often closed by ten or eleven; almost always before twelve o'clock. Its beautiful pink and purple flowers turn a commonplace fence into beauty.

The pimpernel always closes early in the afternoon, like most other flowers that open early in the morning. None of the evening flowers open before about six o'clock. If we look at the moon flower in the garden by day, we shall find all its flowers are closed, limp, and discolored. But early in the evening, if we watch it, we shall see the fresh buds burst suddenly, and the beautiful white petals expand before our eyes. At the same time their strong, sweet perfume will fill the air. We may observe the white tobacco plant of the garden and the white campion of the grainfield behave in much the same way.

A CLOCK THAT TOLD THE TIME BY THE OPENING OF THE FLOWERS

Linnæus, the great Swedish botanist, was so struck by the way in which so many flowers kept regular hours for opening and closing that he made a

floral clock by planting a bed with plants which opened their flowers one after the other. Of course, such a clock could only be used in summer-time.

There is no doubt that plants can tell what is the time of day by the amount of light, and until the proper strength of light is reached the bud of the plant does not open. But this does not explain the whole matter, for there are times of day when the evening light is of the same strength as the morning light.

HOW THE FLOWERS OPEN IN TIME TO RECEIVE THEIR INSECT GUESTS

During the summer months, when the greatest number of plants flower, the light at six o'clock in the evening is just as intense as it was at six o'clock that morning. So the plant that should flower in the morning must have some other means of telling the difference between morning and evening, and it is not easy to say how it does so. There can be little doubt that plants have some special powers of which we know little or nothing.

Why one plant opens in the morning and another in the evening is a question that we can answer without much trouble. All flowers that invite insects to fetch and carry pollen for them must take care to have their flowers open during the hours those insects are flying about. If they are not open at these times, their bright colors and nectar to attract and reward will be wasted, and, worse than all else, they will produce no seed. Therefore we find that as bees are abroad early, the flowers that want their aid are also open early. Few butterflies are about before nine or ten o'clock, and so the butterfly flowers only open about that time, and close about five or six in the evening. Few moths fly before dusk, so the moth flowers remain open till late at night and close till at least six in the evening.

A FLOWER THAT REMAINS OPEN ALL DAY AND ALL NIGHT

The honeysuckle is a flower that makes use of bees, butterflies, and moths, so its flowers remain open all day and night. Many plants have their pollen carried by some special insect and no other, so they have learned to keep their flowers open only during the hours in which that insect is at work.

The question of the effect of light on the opening of flowers brings us back, for a few moments, to the question of dwelling-places, because we shall find that the amount of light in different places has played a large part in their choice by the plants that grow there. If we walk through a pine-forest we shall be struck by the small number of plants we find there. The greater part of it is carpeted with a deep layer of dead pine-leaves, with here and there rounded cushions of a silvery-green moss. There are two reasons for this: one is that this leaf carpet is rather dry, but the chief reason is that the leafy twigs at the top of the trees form a roof that shuts out much of the light in both winter and summer, and few plants can grow in the dim light that comes through.

A beech-wood, in which the leafy branches come lower down the trunks of the trees, is also rather dim in summer; but in winter and spring, when there are no leaves, the light is strong, and plants can do well in it so long as they get their year's work all done before the summer comes. This means that the plants living there have had to learn to get their flowering over in the spring.

WHY THE BEECH-WOOD HAS FEWER FLOWERS THAN THE OAK-WOOD

Spring is the time to see the entire floor of the beech-wood carpeted with such flowers as wood anemones, and the one woodruff, violets—not in ones and twos, but in countless myriads. In summer-time their leaves have mostly disappeared and only their ripe seed-vessels are to be seen, among some later plants that like the dimmer light.

In summer we shall find very few plants in flower in the beech-wood, and those that are there are plants that live chiefly upon the decaying beech-leaves, and so require less light. The false beech-drops is one of these, and it gets all it wants from these leaves; therefore, it does without leaves of its own or any green parts. Where a little light comes sideways under the branches, another kind of beech-drops, living on beech roots, is found, together with sanicle, that lays its leaves flat on the bare ground to get all the light it can.

In oak-woods, which are also on moister soil, the light is stronger because, owing to the way in which the sides of the oak-leaves are cut, a good deal more light finds its way between the leaves and branches of the trees. So we find

many more wild flowers—and with them ferns—in the oak-wood than in the beech-wood. But whether in oak-wood or beech-wood, or even under the shade of hedges in the lanes, the greater number of the plants have to get their work done in spring, before the thick growth of leaves overhead shuts out the light and causes them to rest.

WHY THE FLOWERS OF SPRING ARE FOUND BENEATH TREES AND BUSHES

That is why some of them appear to be in such a hurry to pop up their heads as soon as the frosts have gone, and why they have disappeared altogether from sight before the wild roses are out. If we think of any wild flower of spring, and the place where it grows, we shall almost always find that the place is overshaded by the trees and bushes when they are covered with leaves, or by the summer-flowering plants of taller and coarser growths.

Long, long ago, some of the plants with the smallest flowers must have found out that, with bigger and higher flowers around them, they were in danger of being overlooked by the insects. It was not to their interest to make their flowers large, because they were already fitted for the small beetles and flies that did the work of carrying their pollen for them. So they hit upon the good idea of bringing a large number of their tiny flowers together. You will find this idea carried out by such plants as Jack-by-the-hedge, the bedstraws, woodruff, and others. Then plants like the parsley, carrot, parsnip, hogweed, and a host of others, arranged their tiny white or yellow flowers each on a little footstalk, but made a score or two of these footstalks start off from the tops of a tall stem, so that they looked like the ribs of an umbrella when the wind has blown it inside out. On that plan all the tiny little flowers came close together in a flat bouquet, and, of course, were then seen as easily from a distance as any large flower.

HOW THE PLANTS WITH LITTLE FLOWERS IMPROVE THEIR BLOSSOMS

The elder-tree and the wayfaring-tree followed a similar plan, and made huge flat bunches of their small white flowers. But the guelder rose improved upon the plan. It seems to have said: "We can make our bunches larger still, if the outer row will agree to give up their *stamens and pistils, and put all their* strength into making themselves as big *as they can." So the outer flowers,* though they wanted to make seeds as well as the others, agreed to give up their own wishes for the good of their race, and to-day, if we look at a bunch of these flowers, we shall find that the outer blossoms are twice the size of the others, but they have not a stamen or a pistil among them.

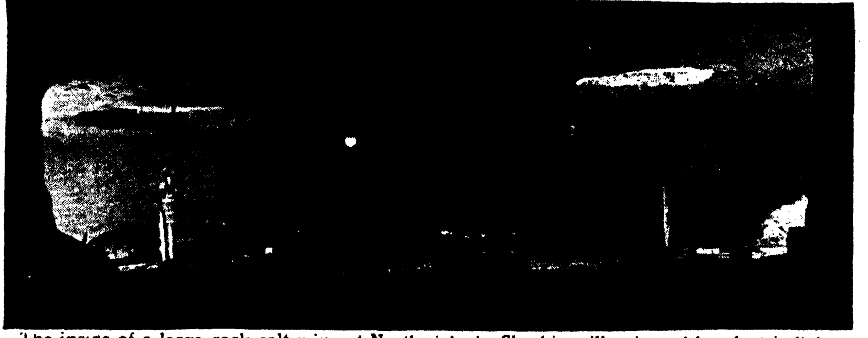
We do not know that plants copy each other, and try to "go one better," as boys and girls and men and women do; but if we were telling a fairy story about the flowers, we should feel warranted in making the dandelion say: "I know a better plan than that. What a waste to have all those short footstalks to your flowers! Build a platform at the top of your flower-stem, and on that pack a couple of hundred flowers as close as they will go." What we call a dandelion flower is really two hundred flowers, as you can see by pulling one of the golden flower-heads to pieces.

THE DAISY THAT PACKS ITS WHITE AND YELLOW FLOWERS ON A PLATFORM

Then, in our fairy tale, we could make the daisy say that it had a better plan even than that of the dandelion. "I shall pack my flowers together as she has done, but I will make mine brighter by getting the outer row to give up their stamens and put their strength into making long white ribbons to stick out all round, and set off the yellow flowers in the middle. They need not give up their hope of seeds; they can still have their pistils, and the insects will bring enough pollen for them as well as for the yellow flowers." If we pick a daisy head and compare it with a dandelion head, we shall see just this difference between them. Thistle and sunflower, tansy and oxeye, coltsfoot and ragwort, hawkweed and chicory, have all heads of closely packed flowers, and they look as though some had copied the dandelion, and others the daisy.

When we are out of doors, in the garden or the fields, we must look at all the kinds of flowers we can find, and must take note of their shapes and colors, and see where they grow, and what kinds of insects are settling upon them. Then we shall become interested in all the flowers and learn to love them.

THE NEXT STORY OF PLANT LIFE IS ON PAGE 4133.



The inside of a large rock-salt mine at Northwich, in Cheshire, illuminated by electric light.

WHERE DOES SALT COME FROM?

CONTINUED FROM 3911

THIS question may mean various things. Most of that which we call earth and rock consists of salts of different kinds, especially salts of such metals as calcium, aluminium, sodium, and potassium. These salts were formed ages ago by the burning or combining of these elements with oxygen and others.

But when we speak of "salt" we usually mean common salt, which chemists call sodium chloride, and which is a compound of the metal sodium with the non-metal chlorine. Sodium and chlorine have a very strong attraction for each other, and the salt in earth and water must have been formed almost as soon as any natural compound.

Salt is extremely soluble—that is, melt-able—in water; and so the greater part of the world's salt is to be found in the sea. But great deposits of salt, called rock-salt, are also to be found on dry land. These have been formed by evaporation of salt water at some time when the sea was retreating from what is now dry land. What happened was that the sun sucked up the water of the sea into the air, but the salt which men now dig up out of the salt-mines was left behind.

WHAT IS THE CAUSE OF QUICKSANDS?

Quick is really an extremely old word which means living, or moving. These words, living and moving, were thought to mean practically the same thing long ago. A quicksand is a bank of sand in water; perhaps in the sea, or a lake, or a river, or we may even meet a quicksand when we dig in the earth. The sand moves with the water which is around or in it, and thus a person or a boat that is caught in such a sand may be gradually drawn down into it, as the water, and some of the sand with it, sinks.

The famous Goodwin Sands, off the English coast, were once an island. They may be quite firm and dry in parts for hours, but when covered by the sea they shift and become quicksands. In this state they are dangerous to vessels that are caught upon them. The weight of the moving sand is tremendous and irresistible. We must not think of it as sticky. It is the weight and the movement that give it its terrible power. Some 200 years ago thirteen warships were lost in a night by the power of these treacherous quicksands.

WHAT IS THE PULSE?

Most of us have seen the doctor place his fingers on a wrist, and have heard someone say that he was feeling the pulse. Perhaps when he has gone we have tried ourselves to see if we could feel anything particular there, but unless we know exactly where to feel we may not have discovered it.

If, however, we hit upon the exact spot, we should feel something throbbing just underneath the skin, just a little tube expanding and contracting seventy or eighty times a minute.

As a matter of fact, that is just what the pulse is, and that is what happens. It is a wave of blood which is being sent along an artery by the force of the beating of the heart, and as the wave is confined inside this vessel or artery, which was already full of blood, the artery has to dilate or expand in order to receive the blood which is being pumped into it. Each time this happens we feel the throb, so that by feeling our pulse, and counting how often it beats or expands in a minute, the doctor can find out how often our heart is beating in the same time, because each throb of the pulse corresponds to a beat of the heart. We should understand, however, that the pulsating movement is not only to be found at the wrist ; it occurs in every artery all over the body.

HOW CAN DOCTORS TELL OUR TEMPERATURE BY FEELING OUR PULSE ?

The rate at which the pulse beats and the height of the temperature in the body have a distinct connection with each other, and go more or less together, so that when the doctor counts the pulse rate, and finds that it is just the rate it should be, he expects also to find the temperature quite usual. If, however, he finds that the pulse is twice as rapid as usual, he will also probably find that the temperature is much higher than normal, because the thing that causes the one to become rapid causes the other to go up. Thus, in all cases of fever, where there is some poisonous substance in the body, this substance causes the heart to beat quickly, and the pulse to become rapid, and it also causes a disturbance in that part of the brain controlling the temperature, so that both the pulse and the temperature are thrown out of gear.

WHY ARE SOME DISEASES INFECTIOUS AND NOT OTHERS ?

If we had asked this question a hundred years ago, not even the wisest men could have answered it ; but we know now that what we call infection is due to the presence of a vast number of very tiny living cells called germs, or microbes, or bacteria. These little creatures are so small that it requires very high magnifying powers in a microscope to see them, but it is by their action on the living tissues of plants and animals that many diseases are produced. Some germs are so small, and so light, that they can be carried about in the air and breathed out from our lungs, so that they may contaminate the atmosphere or our food, and so spread disease wherever they go. That is what is meant by carrying infection. The germs which cause typhoid fever or diphtheria often get into a milk supply or a water supply, and so cause an epidemic amongst all the people who use that source of water or milk.

There are many diseases which are not infectious, because they are not caused by these germs. For instance, many diseases are due to various forms of violence and pressure. This may be caused by lack of blood, or by blood being stopped from circulating properly. Still other diseases are due to various chemical substances which act as poisons upon the tissues of the body, while others are the result of extremes of heat and cold.

But all these concern only the individual to which they apply at the time, and are not capable of being transmitted to somebody else, as are the diseases caused by living creatures.

WHAT CAUSES CRAMP ?

Cramp is really a spasm or contraction of a whole limb, or sometimes only of one or two muscles in a limb, or in the body. It may be very painful, or may be present along with numbness. We have, perhaps, often felt a sudden pain in playing some game or other when we are seized with cramp in a muscle, and this pain has, perhaps, passed off after a little vigorous rubbing. It may also be caused by over-exertion and severe cold, and is probably due to some complicated change occurring in the muscle itself.

A sharp rubbing over the surface of the muscle will usually put it right ; but if we should happen to be seized with cramp when swimming, we can easily understand that it is very dangerous, because we must get to land before the cramp can be treated, and the fact that we have been seized with cramp might prevent us doing so. This is one of the reasons why it is dangerous to stay too long in cold water when bathing, or to go beyond our depth.

WHY DOES MANURE MAKE PLANTS GROW FASTER?

Do we know what growing is? It is a very wonderful and complicated process which takes place in both plants and animals, and depends upon proper kinds of food, and sufficient quantities of it, being supplied to these living things. If plants are neglected, or if children are half-starved, they grow up puny and weak and ill-formed, and the way to prevent that is to supply them with plenty of good food and fresh air. But, in addition, every kind of living tissue has a special kind of food which suits it better than anything else, and the more it gets of this kind of food the more perfectly it grows. What we usually call manure is more or less decayed stuff—the bodies of other plants or other animals that have died.

This is just the food which is more nutritious than any other for plants and crops, so when the gardener or the farmer wants to grow his plants or his crops as quickly as possible, and to get the best he can, he finds out what kind of foods suit them best, and these he gives them in the form of manure. Nowadays there are many kinds of specially prepared substances which act in this way, and scientific men, by discovering these special foods, have shown us how to grow plants and crops in soils in which they would not grow before.

WHY DOES A TRAIN NOT RUN OFF THE LINES WHEN ROUNDING CURVES?

This is a very wise question, because it assumes the truth of Newton's first law of motion. That law says that a moving thing tends to go on moving in the same direction, and, indeed, must do so, unless something alters it. It follows from this law that the train going round a curve must run off the lines unless some forces are brought to bear that will alter its direction.

As we know, trains can be made to run round curves. We simply have to find out what the arrangements are which interfere with the tendency to move straight. We first think of the flanges on the wheels, but these are of small importance. If there were nothing else, the train would ride off the rails in a moment. The next point is the way in which the wheels are cut, as we can see on page 920; and, finally, there is a most important arrangement by which the outer rail on a curve is raised. When the railway is made, men have to calculate how sharp the curve is, at what rate trains are permitted to go round it, and then they have to raise the outer rail in proportion. We see just the same thing on a cycle-racing track, which is banked at the curves. The resistance offered by having to go uphill, so to speak, keeps the train in the path we desire. We are opposing the force of gravity to the tendency of the train to move straight on.

HOW IS IT THAT THE FOG DEADENS SOUND?

The intensity of sound varies according to the law of physics, which is equally true for light, for heat, and for gravitation, as well as sound. This law states that the intensity varies inversely according to the distance, so that the further off the sound is the less audible it is; but that is not the only thing which causes the intensity of a sound to vary. The second condition is the density of the medium through which the sound is transmitted. For instance, no doubt we have noticed how clearly we can hear sounds on a frosty night, and the reason is that the air is more dense and transmits the sound more readily.

On the other hand, if a gun is fired on a mountain of a very great height, where the air is extremely rarefied, the sound is no greater than that of a toy pistol under ordinary circumstances. Now, in the case of a fog, the solid particles in the air may affect the transmission of the waves of sound, but the main thing which influences the intensity of any sound is the density of the atmosphere.

WHAT ARE CORNS?

A corn is a hard growth which occurs on the toes or some other part of the feet, and is generally the result of wearing a shoe too small for the foot. The corn itself is composed of the outer part of the skin, and the overgrowth of this skin in a lump, which produces the corn, is caused by the pressure of the shoe at the spot. But the corn would not result unless the pressure was taken off at intervals, and this, of course, is done when we take the shoe off. If the pressure were kept applied to this spot all the time continuously, the skin, instead of overgrowing at that point, would waste away. It was once the

custom in China to place a very tight bandage round the feet of the ladies, and this was kept on always, with the result that the feet did not grow to their proper size. So that the result of the pressure on the skin depends entirely upon whether it is continuous, and whether it is severe. The overgrowth of the skin is due to the irritation produced by the pressure.

WHAT ARE FRECKLES?

What we usually speak of as freckles are spots of a yellowish-brown color which are seen on the skin of some people, especially after they have been exposed to strong sunshine for some time. They occur chiefly on the face, on the neck, and on the hands, because those are the parts of the skin unprotected by clothes. Some people are much more liable than others to have this coloring produced, and in some it disappears quite quickly, while in others it lasts a long time.

In all these cases the freckles are the result of the action of the sun on certain cells of the skin, which causes these cells to produce coloring matter, or pigment, which remains there for a certain time. There are cases, however, in which freckles do not appear to be caused by very hot sunshine or exposure, but which come naturally, just as the color of the skin itself is either fair or dark, according to the tendency inherited by the individual.

WHY DOES ANYTHING PUT ABOVE A FLAME ATTRACT IT?

The direction a flame takes depends entirely on the currents of the air moving around it. If the flame is burning in a still atmosphere it points straight upwards, because the hot air above it is lighter than the colder air below, and so tends to rise and make a draught upwards in the direction of the flame which has to be filled up by the cold air beneath. Now, if we hold, say, a key above such a flame, this process is made more marked because the hot air is turned aside by the key, and so makes a stronger draught, the current of which points to the centre of the key. The air at that spot is hotter than it is anywhere else, and rises very rapidly, and the hotter it is the stronger is the draught in that direction. Therefore, the point of the flame is attracted to that spot.

WHY DOES NOT THE WATER FALL OUT OF A QUICKLY REVOLVING PAIL?

We must remember that every substance, whether it be a solid or liquid, tends to remain in the same position unless some force is applied to it to move it. The force of gravity keeps the water in the pail when the pail is at rest, and attracts both the pail and the water to the earth. When we swing the pail over our heads, gravity would cause the water to fall out if we held the pail still, but by keeping it moving we bring other forces into action which act in other directions, and tend to make the water press against the sides of the pail.

If the water could get out it would not fall straight down to the earth, but would go on some distance in the direction in which the pail was moving at the moment, and would gradually come to the earth. So that the water stays in the pail as the result of the several different forces acting upon it while it is being swung quickly round and round.

WHY DOES A BEE DIE WHEN ITS STING COMES OUT?

What we call the sting of a bee is not really meant to be used as a sting. It really exists to help the bee lay its eggs, and when the bee uses the sting, it is generally roughly torn away from the bee's body, causing damage which is usually fatal. This is a very curious case where part of an animal's body has had its real purpose changed; but the change has required a heavy cost, for the sting cannot be used except at the risk of the bee's life.

This means that to use its sting is an act of suicide on the part of the bee, and if a bee lived for itself, this would indeed be a foolish means of protection. But every bee lives for the hive, and the real use of the sting is not to attack us, for instance, when we hit at a bee with a handkerchief, but to protect the beehive from its enemies. The bee's sting is not a weapon of offence, but of defence — not self-defence, but hive-defence. It is used only under provocation, and only for the sake of others and the future of the bee race. The bees that sting do not themselves lay eggs, and so it is that they are able to turn this part of their body to quite a new and utterly unselfish purpose.

IS IT TRUE THAT THERE IS THE SIGN OF A LOST EYE ON OUR BRAIN?

It is quite true that there is a part of the brain which is supposed by very learned men, who have studied the brains of all kinds of animals, to represent an eye which occupied the position of the middle line of the head right in the centre. This structure is still present in animals to-day, and even in man himself, although it no longer has any function belonging to sight. But, curiously enough, there is still existing in the far-off country of New Zealand a lizard whose proper name is sphenodon, in which this central eye is so near the surface that it can still be affected by the rays of light.

This curious creature seems to be the only remaining animal in the world in which this eye exists. It is thought, therefore, that some animals had originally one eye in the middle, and that as they evolved into more complex creatures the one eye has become separated into two, a right and a left eye.

WHY CAN ONE HEAR A WHISPER ACROSS THE DOME OF THE CAPITOL?

Perhaps we have often noticed, when we have been in different buildings listening to somebody speaking, either at a lecture or in a church, that it is sometimes much easier to hear the speaker than at other times, and that this does not seem to depend upon the size of the building. In fact, in some very large buildings it is very easy to hear perfectly, and in some quite small buildings it is extremely difficult.

It all depends upon the shape and arrangement of the walls in relation to the sound-waves which have to come to our ears before we can hear anything. Now, the construction of the dome of the Capitol at Washington is such that the sound-waves which are set up even by a whisper are so controlled that a person standing at a distance can hear them distinctly. It is a mere matter of directing and controlling waves of sound so that they are not dispersed, and that is why we hear them.

DO WE ALWAYS WAKE WHEN WE HAVE HAD AS MUCH SLEEP AS WE NEED?

This is an extremely important question, because the answer to it must decide one of the most essential points in taking care of children. At one time, the view used to be held that children were naturally lazy and naughty, and that Nature in general had done things so badly that, to give the children a chance, it was necessary for grown-up people to interfere with everything that the little ones inclined to do. On this theory, the children were awakened at a fixed hour, as if all children required the same amount of sleep, as if the same child always required the same amount of sleep every night, and as if all sleep were of the same quality, and so could be measured by hours. This was all wrong

People who really know—because they have given their lives to studying the subject—are certain that a child will wake when its brain has had all the sleep it needs. The waking is the proper fruit of the sleep. A child could not sleep too long, because directly sleep has done its work the brain must wake; that is what sleep is for. On the other hand, the slightest noise may awaken children before they have had their sleep out, and then grown-up people call them cross and naughty, and say they have got out of bed the wrong side, and all that sort of nonsense. It is only a few children that get all the sleep that Nature asks for them, and it is believed that a large number of these children afterwards become the leaders of their generation.

WHAT MAKES NOISE, AND CAN IT BE HEARD WHERE THERE IS NO AIR?

What we call noise is all those kinds of sound which have no musical quality. They are not musical because they consist of waves in the air which are not regular, but which just come "anyhow" against the ear.

We usually speak of sound as a wave in the air, because that is what it generally is. Certainly it cannot be heard where there is no air, if by "no air" we mean a vacuum—a space from which the air has been removed as far as possible. But the waves that make sound can be carried through other gases besides those that make up air, or through liquids or solids. Sound travels quite readily, for instance, through water. We know only too well that it travels through solids, for closed windows do not exclude the street sounds from our ears, though they make the sounds less. This means that the waves movement of the air outside the window is communicated to the glass, and then by the glass to the air inside the room. The

glass cuts off some of the sound, because a certain amount of power is lost in transferring the wave from one medium, as we say, to the other.

Though noise and sound in general can be conveyed through any kind of matter, whether solid, liquid, or gaseous, what we call the ether cannot convey sound. Thus there can be no sound in the depths of space, and not the greatest noise made in the sun could ever reach the earth. On the other hand, *nothing but* the ether can convey light.

HAVE THINGS ANY COLOR AT NIGHT?

Of course a thing has color at night, or at any other time if it gives out color of its own, as a fire or a gas-jet does. The things that give out light of their own we call luminous. The question really is: Have things that are not luminous any color at night? Now, when we say color we mean colored light, light of such a kind that it gives us a feeling which we call color. If there is no light there is no color. Even a non-luminous thing may have color at night if there is light in the room. So now we can put the question in the exact and proper way—Have non-luminous things any color in the dark?

The answer to that question is: Certainly not. An orange is yellow because when yellow light, or white light containing yellow light, is thrown upon it, it has the power of throwing the yellow light back to our eyes, and so we call it yellow. If no light falls upon it, it can throw no light back, as, unlike the fire, it produces no light of its own; and so, of course, it has no color in the dark, nor has anything else that does not produce light of its own; and if it did produce light it would not be in the dark. In a word, what we call color is a kind of light, and where there is no light there can be no color.

WHY DOES THUNDER TURN MILK SOUR?

Thunder, we know, is a disturbance of the air which we hear as noise, and which is made by the passage of electricity, which we call lightning, through the air. This noise in the air does not turn milk sour, so directly we think what we really mean by thunder, we see that the question has not been put quite in the right way. All the same, we know that, at times when it thunders, milk very quickly turns sour; and though we see, of course, that the thunder does not turn the milk sour, we must find out what it is that does. The answer is that there is something in the state of the air in thundery weather which affects the milk, and this it does whether we happen to hear thunder or not. The air in thundery weather is charged with electricity; that is a very vague phrase, but we really cannot make it more precise yet. It is also, as a rule, very moist and very warm. These three conditions, especially the presence of the electricity and the warmth, greatly favor what goes on when milk turns sour. And that is why milk keeps fresh such a short time in thundery weather.

OF WHAT ARE OUR EYES MADE?

In another part of this book we learn how our eyes are built, but this question about the stuff of which they are built is well worth answering. If we could take an eye to pieces, and sort out all the different things of which it is made, we should find that, like the body in general, a great part of it was made of water, certainly not less than four-fifths of it. Besides water we should find the various elements that go to make up living matter, or protoplasm. In the eye we find many kinds of cells which consist of protoplasm, and others, such as the cells of the lens of the eye, which, though they were made by protoplasm, consist of something else quite peculiar to themselves.

But in the curtain of the eye we should find the protoplasm mainly in the form of nerve-cells, and if we trace back the development of the eye, we find that the most important part of it—the part which really makes it an eye—has grown out from the brain, and is really a little part of the brain pushed forward. Part of the front of the eye is really skin that has been changed for the purposes of an eye, but the part that really makes the eye an eye is just as certainly part of the brain, when we come to know its history, as the rest of the eye is part of the skin.

DOES IRON OR STEEL BECOME TIRED?

When we speak of anything growing tired, we naturally think of a living creature, such as ourselves. We know that we, when we are not tired, can do certain things, but when we are tired, some change has occurred inside our bodies that prevents us from doing those things.

The proper word for this state is fatigue. Now, if we take a piece of steel like a razor, which can do certain things, such as cut very sharply, and if we overwork it—as we should say if we were talking of a horse—we may find that it will not cut as it used to do, however carefully we prepare its edge. Something has happened to it which prevents it from doing what it was able to do before. We are quite entitled to call this "getting tired," as we do in the very similar case of ourselves.

The fatigue of metals, as it is called, is now a well-known fact, to the study of which at least one well-known student has devoted much of his life. It may be of very great importance at times in the use of tools and machinery, as anyone may guess who finds that his razor needs a rest. But the fatigue of metals is also very interesting in another way, especially when we begin to learn how it depends upon changes in the way in which the molecules of the steel are joined to each other. For it may be that, if we could learn fully about the causes of tiredness and the cures of tiredness in razors, and things like that, we might better understand fatigue in ourselves, how to prevent it and how to cure it.

WHY ARE THERE TWO TIDES A DAY?

This is a very puzzling question, to which very few people know the answer. The earth only spins round once in a day, and the moon pulls the water up towards itself on the side of the earth next the moon, making what we call high tide. Anyone would think, then, that there must be only one high tide a day. But the moon not only pulls up and heaps up toward itself the water on the side of the earth that is next it at any given moment; it also pulls the earth towards itself away from the water on the other side of the earth, the side farthest from the moon.

The moon attracts the earth more powerfully than the water on the far side of the earth, since that water is farther away from the moon. So when it is high tide anywhere, it is also high tide on the other side of the earth. This must mean that we get two high tides in twenty-four hours.

The first of them, perhaps, is due to the moon heaping up the water on the side of the earth next it—the side of the earth where we are. But twelve hours later the earth has spun round so that we are on the side away from the moon, and now the moon is pulling the earth towards itself more strongly than it is pulling the water, so the water where we are is heaped up again, and that, of course, makes the *second* high tide we have in the twenty-four hours.

DID MAN ALWAYS TALK?

We can only give a *probable* answer to a question like this, for evidently we have no certain way of finding out the answer. Some people have supposed that there must have been a time when man did not talk, and so they have given a special name to men of that period. But we may be almost sure that they are wrong. The lowest kinds of human beings now living certainly talk; but they are much higher than the first men were, no doubt.

We know that the highest kinds of apes have a sort of language, and that makes it probable that the earliest men had a language too. Indeed, many people think that language, or speech, is exactly the thing that makes man, and that man, therefore, when he appeared on the earth, was able to speak, and that men have always been beings that could talk. Another way of saying this is that we could not call beings human who had not the power of speech in some form or other. Such beings could not teach one another from generation to generation as human beings do, and, in a word, they would only be animals, to say the best of them.

DID MAN ALWAYS WRITE?

Writing is a form of speech, only written instead of spoken. But it is very much more difficult to learn, as we all know; and if we think for a moment, we shall see that it must have been much more difficult to invent. Indeed, a simple kind of speech scarcely required invention at all, for it could grow out of mere noises that meant pleasure, or anger, or distress. But writing requires invention. It needs people to agree with one another that certain marks shall mean certain things; and this is true even though we know that writing grew out of simple pictures of things like the eye, or a man standing that anyone could recognize.

We do not think there can be any doubt that, just as we all can talk and understand what other people say long

before we can write, so mankind could talk long before writing was invented. We have evidence of the existence of human beings who have left us rude pictures scratched on bones, for instance, but no signs at all of any kind of writing. Indeed, "man before writing," was, until lately, supposed to have lived in Europe not many thousands of years ago; and though we now know that writing goes back much farther than we used to think, we can compute fairly well about the time that it was invented. It was easily the most wonderful invention of all time.

WHY DOES HEAT MAKE PAPER CURL UP?

There is a certain amount of water in all ordinary things. The amount of water in a sheet of paper makes it heavy. We know how heavy and limp a piece of quite damp paper is. If we heat the paper, we drive the water away, because we change it into a gas that passes off into the air. Spaces in the paper that were filled with water before are now filled with air, which is very much lighter. If there are any forces in the paper tending to make it curl up, they are now free to act, for they have not to lift the weight of the water that was previously in the paper.

Also, we must remember that paper, like almost everything else, shrinks, or contracts, when it is cooled, and expands, or takes up more room, when it is heated. If the change in temperature occurs at exactly the same rate in every part of a thing, then, as its size alters, its shape will not alter; but if one side of a thing gets hot or cold at a slightly different rate from the other side of it, then its shape will change, and if it is a thin, flat thing we shall notice the change by finding it curl up.

WHY DO THE WAVES CURL OVER AND BREAK?

If the question had been "Why is a man who steps off a moving train likely to fall on his nose?" the answer would have been just the same as to this question. The man's body is all moving as he steps off the train. But when his feet touch the platform, their motion is stopped—unless he is careful and at once runs quickly enough. The rest of his body goes on moving, however, and as his feet are left behind, he will topple over and fall, even if he does not break up like the waves. In the same way, when the wave reaches the shore, its feet, so to speak, are caught and held back by rubbing against the sand or shingle; but the rest of the wave moves on, and so it topples over and breaks.

WHY DO TREES GROW TO A CERTAIN HEIGHT AND THEN STOP?

Well, we might ask the same question of men, or horses, or birds, or any other living creature, as of trees. The reason is that the growth of living things is not like the growth of a snowball or a crystal. Such things simply go on growing the more "food" they get. There is nothing inside them limiting their growth. But every living creature has the marks within it of something that has a purpose—which snowballs and crystals have not—and that purpose is simply *to live*. In general we may say that living things grow to the size which suits them best, and so favors their life best; when that is done, they stop growing, and merely maintain themselves as long as they can. We have to think of every living creature as if it had a plan, a definite course of action which it had resolved upon, and which it will pursue if the conditions outside allow it to do so. It grows to the shape and the size to which it is *meant* to grow, and then no powers on earth, no amount of food and air and light, will make it grow even the least little bit more.

WHAT MAKES A LEAD PENCIL WRITE?

The ancients, and modern engravers also, used pencils made of pure lead and pure silver. Nearly all metals are too hard to rub away against paper sufficiently for us to notice any marks; and there are few metals whose color would show well against paper. A "lead" pencil is made of a vast number of tiny crystals of carbon. This form of carbon is called graphite, from the Greek word for writing. The crystals are small, and of such a shape that they can easily be rubbed away from each other.

If there were no such thing as friction, the pencil would not write. The power of friction, or rubbing, depends upon the force with which the rubbing surfaces are pressed against each other; so the firmer and harder we press with our pencil, the more graphite is rubbed down by friction on to the page to record the track of our "lead" pencil.

THE NEXT QUESTIONS ARE ON PAGE 4109.

THE ARAB PATRIOT OF ALGERIA

CONTINUED FROM 3824

ABD-EL-KADER, whose name means "servant of the mighty God," was an Arab of Algeria, born in 1807, and a man of remarkable character. With a fine and graceful figure, and a body of great strength and endurance, he was unsurpassed in courage, profoundly learned, and had high standards of duty and honor. He had, too, a powerful influence for good over all with whom he came in contact. When a young man of twenty-six, he left his life of study and religious meditation to lead his people, as Sultan, against the French invaders, and for fourteen years he tried to free Algeria from the foreign yoke, and form a great Arab nation.

Alone, or with a few horsemen, he would appear in a remote part of the Atlas Mountains, or in the Sahara, and rally thousands to him. When the French anticipated an attack in their rear, he would suddenly appear in front, as we see in the picture He could shoot accurately while standing in the saddle, with his black Arab horse speeding like lightning; or he would enter a town and harangue the townsfolk into defence of their country and religion. He treated his prisoners as guests, sending them money, clothes, and food. Formerly, Arabs had killed their prisoners. Some women were once captured and brought to him, and as he set them free he exclaimed in anger: "Lions attack strong animals; jackals fall upon the weak." Often Abd-el-Kader and his brave followers had insufficient food, or galloped for days together over the desert sands. Once when they were living on acorns, a stray sheep was brought to him. "Take it to my starving soldiers," said the leader.

But the resources of France were limitless, and though many armies were sent in vain, 100,000 disciplined troops in the end overcame the little remnant of the Arab forces. Even then, when Abd-el-Kader wandered with hardly a follower, such was the terror of his name that the French had to keep a large army on foot.

Not until his cause was utterly hopeless, in 1847, did this brave man surrender, on condition that he and his family should be free to live in Alexandria or St. Jean d'Acre. That promise was not fulfilled, for he was kept a patient prisoner in France for many years. They offered him wealth, a château, a guard of honor; but he indignantly refused them, demanding that France should redeem her pledge. In 1852 Louis Napoleon saw that this was done, and he was set free.

In 1860 a Turkish mob rose against the Christians of Damascus, where Abd-el-Kader was then living. With some Algerian soldiers he saved the lives of 15,000 people, and from that time honors and distinctions were heaped upon him, until his death, in 1883.

THE BOY WHO TOOK A MAN'S PLACE

ABOUT 150 years ago a young boy, who was ready to make a start in life, was apprenticed by his friends to the captain of a Scottish coasting vessel, and although in those days the seaman's life was a very hard and perilous one, the boy had sufficient liking for the sea to throw himself with all his heart into his duties.

But storms and tempests were not the only risks to which the seamen of those days were subjected. There was the press-gang, which might seize on a man and put him on a ship that was leaving England perhaps for years.

Life in the Navy was so full of brutalities and hardships that it was most unattractive, and sufficient men could not be obtained by ordinary recruiting to man the vessels of war. The press-gang was therefore set to work, and bands of ruffians used to raid a vessel or a town, seize any likely man, and carry him off to a warship, quite regardless of the fact that he might have a wife and children or an aged mother dependent upon him.

The coasting vessel on which the young apprentice sailed was visited by the press-gang in this way, and every man on board, with the exception of himself and the captain, was seized for war service. The mate had a wife and young family, and his distress at being dragged away, perhaps never again to see them, was so pathetic that the apprentice felt the greatest sympathy for him, and offered his own services if the mate could be released.

The head of the press-gang, an officer of the king, readily fell in with the suggestion, saying: "Ay, my lad. I would sooner, any day, have a likely boy with some spirit in him than a blubbery man. Come along with me."

The boy went, and the circumstances in which his services had been obtained were related to the commander of the warship, who was so pleased with the spirit and kindness of the lad that he promoted him to be a midshipman at once. The lad did his work splendidly, and took the greatest pains to learn his duties, so that promotion followed promotion in rapid succession.

Later he obtained command of a small vessel of his own, and was soon promoted to a larger one, and at last that ambition of every keen midshipman—to be an admiral of the British Navy—was fulfilled, and the young apprentice, who had sacrificed his own interests and comfort for the sake of the mate and his family, became Vice-Admiral Campbell, a name greatly honored in the annals of the British Navy. He died in the year 1790.

A BAND OF NOBLE MEN

WHEN Napoleon was forced to retreat from Moscow because the city was in flames, he fled with the remnants of his army across the bleak, snow-covered plains of Russia, with the enemy's army in pursuit. That was in the severe winter of 1812. It was a terrible march. The hungry, sleepy, frost-bitten men — French, Italians, Germans, and Poles, soldiers from the countries subjugated by the ambitious Napoleon—were scarcely able to crawl along; yet they were urged forward by dread of the Cossacks in pursuit.

Among the Germans was Prince Emilius of Hesse Darmstadt, heading his little band of ten, all that remained of the thousand men he had led eastwards a few weeks before. As night came on, they stumbled upon a burned hut standing out in the dark. Then the Prince Emilius, turning to his men, said:

"Dear brothers, we must rest here, trusting to Heaven that, whether we wake again on earth or not, all is well if we have faithfully borne our part in the toil and suffering."

And so they lay down in the ruins of the hut, and Prince Emilius was soon dreaming happy dreams in which he saw kind faces bending over him.

At last he woke with a start, warm and rested, wondering where he was. Then he remembered the dreary march, the snow, the hunger, and the misery. He looked about the burned hut, but no one was there. Then he discovered that he had been sleeping beneath a pile of garments which he recognized as those of his soldiers. And as the daylight increased, he saw that the doorway was blocked up with the bodies of his noble men, who to save his life had sacrificed their own.

THE GIRL WHO SOLD HER HAIR

AT the time when Napoleon was trying to conquer all Europe, and state after state was falling a prey to his grasping ambition, Silesia, a German territory, was doing her best to beat back his invading armies. Everyone in that freedom-loving state was wrought up to a passion of ardent patriotism in the terrible year of 1813, giving all he could to the cost of equipping an army for defence.

A Silesian girl had no fortune to put at the service of her country. Her small possessions were of hardly any value, yet she burned with eagerness to help her countrymen in their fight against the invader.

One day the idea came to her that she might sell her thick, long hair, and so obtain some money. She accordingly set off to Breslau, where she sought out a hairdresser, and offered him her tresses. He could not understand why she should want to part with her beautiful hair, so she had to tell him the reason. Then he agreed to cut off her hair, but could not afford to give more than two dollars for it. The bargain was made, the hair was cut off, and the girl returned home.

The hairdresser was so touched with this instance of self-sacrifice that he would not part with the hair in the usual way, but used it in making various ornaments such as bracelets. The story of what this Silesian maiden did for her country became known. All Silesia was proud of the act, and articles made of her hair were eagerly bought. So much were they in demand that the hairdresser reaped a golden harvest, and contributed a large sum to the state.

A PRINCE WHO GAVE UP HIS FREEDOM

IN the Middle Ages, Ceuta, which lies just opposite Gibraltar, on the northwest coast of Africa, was a hot-bed of piracy, and King João of Portugal and his sons made an expedition to it, captured it, and released the Christians imprisoned there. Eighteen years later, in 1433, King João died, and soon after two of his younger sons, Henrique and Fernando, laid siege to Tangier, a town farther along the coast.

But the Moors, with their allies, surrounded and entrapped the little army. They were unable to reach their boats, had no food, and were forced to give to the Moors a hostage for the delivery of Ceuta. Prince Fernando offered himself, and then his brother had to leave him. Their elder brother, the King of Portugal, sent a fleet to Ceuta, but nothing was done, and Prince Fernando remained a prisoner.

Soon the Moors were angered that no ransom was sent, and that Ceuta was not yielded to them, so in revenge they maltreated and starved the prince. Now, his mother was Philippa, the daughter of John of Gaunt of England, who had brought up her son to be a man worthy of his knighthood. So Prince Fernando bore his troubles patiently, enduring all so that Ceuta might remain in the hands of his Christian countrymen. The king, his brother, tried to raise an army to free him, but he caught the plague by which Portugal at that time was being desolated, and died from it. His little child, aged six, became king, and quarrels disturbed the land, and thus, as the years passed by, hope of release for patient Prince Fernando grew less and less.

Two kings in Spain, however, touched with admiration and pity for him, planned to attack Tangier and release him, but that only led to his being sent to the King of Fez inland. He put the prince first in a dungeon without light or ventilation, and then made him labor among Christian slaves. But Fernando was so kind to them, and behaved so nobly, that even the King of Fez expressed admiration for him.

After ten years in prison for the honor of his country, brave Prince Fernando died. The Portuguese hold his memory very dear, and call him Prince Constant. The poet Calderon, too, wrote a great play, and made him the hero of it. And though his life was seemingly offered in vain, Ceuta has ever since belonged to the Christians; for when it ceased to belong to Portugal, it passed into the possession of the Spaniards. Thus, what Prince Fernando gave his life for was really accomplished —the rule of a Christian prince at Ceuta.

THE NEXT GOLDEN DEEDS ARE ON PAGE 4089.

SAVONAROLA'S FAMOUS BONFIRE OF VANITIES IN FLORENCE

The power of Savonarola in Florence grew until it became greater than that of the rulers of Florence, and huge wooden galleries were set up in San Marco to hold the crowds that thronged it. Under his influence the people resolved to burn their vanities, and this picture by Mr. F. W. Topham shows the burning of their "vain and unholy things."

LOYOLA · ST. FRANCIS XAVIER · THOMAS A KEMPIS · ATHANASIUS · ST. DOMINIC · ST. BERNARD · ST. JEROME · SAVONAROLA

SOME FAMOUS MONKS

CONTINUED FROM 3942

ROGER BACON

THERE has always been much discussion on the subject of monks and monasteries. In America there are fewer monasteries than in some other countries. American people, speaking generally, are not inclined toward the cloister so much as some other nations. It is not their way to shut themselves away from the world; they prefer a more active life. The American takes more kindly to making steam-engines, or alarm-clocks, or a fortune, than to cutting himself off from the world and devoting his whole life to contemplation or to the service of his order.

But the monk is a picturesque figure. He reminds a world too easily vulgar, too easily satisfied with the frolic of vanity fair, that life carries an immense responsibility. He is one of the texts of Christ in human form: " What shall it profit a man if he gain the whole world and lose his own soul ? " There is more than one way of reading this text, but the monk is at least one rendering of it. He reminds us that, in comparison with eternity, man's life is but a shadow.

There have been bad men in monasteries as well as saints. But chiefly, perhaps, they have been filled with good, quiet, commonplace men, to whom the struggle of life presented either a dull or a terrifying aspect. Here and there the records are lighted up by daring, defiant, or revolutionary and heroic figures, who seem to snatch the falling time in which they lived from the flames of destruction, and valiantly to thrust the world forward on its march of progress. One monk, as we shall see—and he was an Englishman—was the first voice lifted up for science after a silence of fifteen centuries.

Let us begin with the most curious of all monks—and hardly meet to be called a monk—the famous Athanasius. A little man, radiant with intelligence, possessing " the face of an angel," according to Gregory, Athanasius was said to be " quick in sympathy, pleasant in conversation, and still more pleasant in temper, effective alike in discourse or in action, assiduous in devotions, helpful to Christians of every class and age, a theologian with the speculative, a comforter of the afflicted, a staff of the aged, a guide of the young." At the age of thirty-three he was called to be Bishop of Alexandria.

In those days a great controversy tore the Church, and the struggle became at last " the whole world against Athanasius, and Athanasius against it." Again and again he was driven from his bishopric ; again and again he returned. Once soldiers rushed in to take him at the altar. He showed no fear. This devoted son of the Church spent the periods of his exile in monasteries, and, during those times of quiet, wrote some memorable books. He was not a true monk, and was more a statesman than a priest ; but his devotion to his ideas concerning Christ were of the most devout and sacred kind. We owe it to the monasteries in Upper Egypt that some of those ideas have come down to us. Athanasius was born about 296 and died in 373.

HOW A CHILD'S VOICE MADE A BISHOP IN A CITY CROWD

Of all the monks who ever lived, if he can properly be called a monk at all, the strangest is St. Ambrose. At the age of thirty he was so successful as a lawyer that he was made a governor, and lived in Milan. A dispute arose between two sects of the Church over the election of a bishop. There was a dispute in the church that was almost a war. Ambrose hurried to the scene, and made an earnest and eloquent appeal to the people for Christian behavior. As he ceased speaking—so says the legend—an infant's voice suddenly cried out : " Ambrose is bishop."

The crowd took up the shout. In vain did Ambrose protest that he was a bad man and not fit at all to be a bishop ; in vain did he try to escape. The whole city insisted, and the lawyer and governor, selling his goods and putting by his robes of state, became a Christian bishop. The day came when he showed his spirit. The powerful Emperor Theodosius ordered a massacre, and the slaughter had been carried out. Ambrose, shocked to the soul by this bloodthirsty outrage, wrote to the emperor, refusing to let him enter the church of Milan.

THE FEARLESS AMBROSE, WHO MADE AN EMPEROR DO PENANCE

The emperor replied that David had committed murder. " Imitate him in his repentance as well as his sin," answered the heroic bishop. For eight months the bishop kept the emperor at bay. Then, one day the emperor's courtiers came to Ambrose and announced that the emperor was coming. " I will hinder him from entering the vestibule," said Ambrose ; " yet, if he will play the king, I will offer him my throat." When the emperor heard this, he said : " I will go and receive the refusal which I desire." But on meeting the bishop he said : " I come to offer myself to submit to whatever you may prescribe."

Ambrose then commanded him to do public penance, and in future—because his temper was ungovernable—to let thirty days run between the order for capital punishment and its execution. Ambrose was a just, fearless, and upright man, and his writings are those of a devout and fervent worshipper of God. Born about 340, Ambrose died in 397.

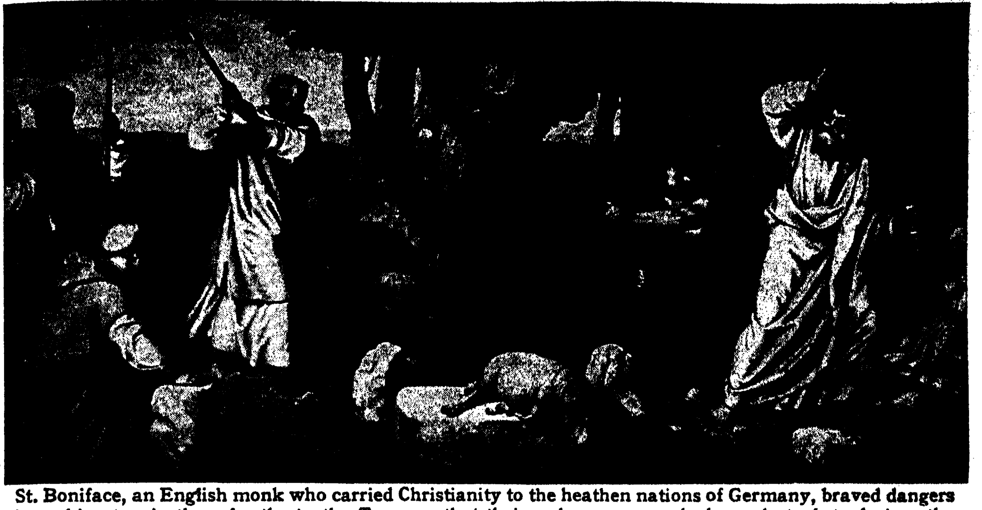
St. Jerome is interesting to us as the Latin translator of the Scriptures. He is also interesting by reason of the picture he presents to us of a man fighting what he considered a dreadful sin, namely, a love of books. Poor Jerome was a scholar. He loved old books, and he could only be happy with venerable authors full of tales of long ago. But a day came when, brought by sickness to death's door, he reflected on the next world, and came to the conclusion that pagan literature was wicked.

JEROME, THE MONK WHO LOVED BOOKS AND FLED TO THE WILDERNESS

Before this time he had been a man who loved to take part in arguments about the Church : now he became a man who wanted to live the Christ-life. He became a hermit, and lived in the wilderness. But in the wilderness there were books in a monastery there, and soon he was among his temptations again ; he again became mixed up in violent arguments. Called to Rome to help in a dispute, he became a great favorite with ladies, and when he set out to the Holy Land, he was followed by a train of admirers. They built three nunneries and a monastery, and Jerome settled down in this monastery at Bethlehem to translate the Old Testament from Hebrew into Latin. Jewish Rabbis came to him by night to help him in his work.

But whenever an argument broke out in Rome, off flew Jerome eagerly, for he simply could not keep himself out of an

TWO MONKS WHO FACED GREAT DANGERS



St. Boniface, an English monk who carried Christianity to the heathen nations of Germany, braved dangers in seeking to win them for the truth. To prove that their gods were no gods, he undertook to destroy the sacred oak of Geismar, and here we see him full of zeal, chopping down the tree before the heathen priests.

St. Ambrose was a governor, and his behavior was so gentle and wise that the people insisted he should be made a bishop. For a long time he refused the honor, but finally accepted. When the Emperor Theodosius presented himself at the door of the church at Milan, after he had caused a cruel massacre in Greece, Ambrose refused him admission, and only withdrew the prohibition after a long penance by the emperor.

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altercation. He was like an Irishman, always spoiling for a fight. So violent was his manner that it is said that his monastery was attacked by furious enemies. To the end of his life Jerome was a scholar and a disputant. No wilderness and no monastery could ever have held this worthy man without books. He was a good man, and deserved his sainthood. Jerome was born about 340 and died in 420.

THE ENGLISH MONK WHO TOOK CHRISTIANITY TO GERMANY

It was a monk from England who, in the eighth century, carried Christianity to Germany. His name was Winfrid, and he was born probably at Kirton or Crediton, in Devonshire, the son of a West Saxon chieftain. As a boy he was sent to a monastery school in Exeter, and became an excellent scholar and a noted preacher. After some years he went to Rome, and from there was sent by the Pope as a missionary to the Germans.

We get a quaint picture of the period in the scene which took place between Boniface and the heathen of Germany to decide between God and Woden. Boniface undertook to chop down their sacred oak. The heathen, thinking he would infallibly be struck down by their wrathful god, stood by to watch his destruction. The oak fell with a crash; Boniface did not. Whereupon the heathen embraced Christianity, and out of the oak Boniface built an oratory to St. Peter.

But alas for poor Boniface! He was himself destined not to end his days in peace. After a life of the most manifold and successful labors; after having converted thousands to Christianity, set up monasteries, built churches, and it is said anointed Pippin king of France in the name of the Pope, Boniface was attacked by a body of pagans, and, offering no resistance to their onslaught, won the glorious crown of martyrdom. The poor old man, frail and delicate, fell before the clubs of savage robbers, and died with his relics clasped in his hand. His life was one of the most useful, hazardous, and courageous ever lived by man, and England may be proud of her missionary. Boniface died in 755.

ST. BERNARD, WHO DENIED HIMSELF PLEASURE AND FOOD AND FRIENDSHIP

One of the most attractive monks in history is St. Bernard, called the "last of the fathers," so simple was he, so full of faith, so quiet of soul, so touched by the Spirit of Jesus. He was the son of a French knight, and as a boy drew others to the religious life. He became a Cistercian monk, and set himself to kill all sense of enjoyment, all desire for pleasure in his own soul. He seldom took food till he was on the edge of fainting, and when friends came he would stop his ears with flax so that he might hear no worldly talk. This was in his boyhood.

Some time later we hear him saying of book-learning: "You will find something far greater in the woods than in books. Stones and trees will teach what masters do not know. Think you not you can suck honey from the rock, and oil from the flinty rock? Do not the mountains drop sweetness, the hills run with milk and honey, and the valleys stand thick with corn?"

He lived the most hard and desolate life, preaching repentance with a rare eloquence. When he was fifty-five, and worn to a thread, he was bidden bestir Europe for a second crusade. Pale and shrunken, to a degree which seemed almost supernatural, he made a long and exhausting tour of France and Germany, preaching with a success so great that in some districts scarcely one man was left to seven women.

HOW THE GENTLE BERNARD SAVED THE JEWS FROM DEATH

Behind this old man came a young monk stirring people up to massacre the Jews. Bernard turned back, reproached the monk as "a child of the devil," and sent him to his monastery. "Had not the tender mercy of the Lord sent priest Bernard, none of us would have survived," said a Jew. That such a tender and beautiful life of fervid piety should have been lived in the twelfth century is a glory of Christianity. St. Bernard was born in 1091, and died in 1153.

One aspect of St. Bernard brings us in contact with another and far different monk of that period, the man Peter Abelard. He is not a pretty character. Possessed of a brain that used logic as a boy uses a top, he gave himself up to disputing about the most ridiculous things in the world. He passed for a scholar of immense learning. His fame spread. He became a peacock of philo-

THE TENDER ARTIST-MONK OF FLORENCE

One of the best-known painters of Italy was the monk Fra Angelico, who lived for years in the same monastery at Florence as Savonarola. He painted to inspire men to feelings of reverence and devotion, and one of his famous pictures is seen here standing on the easel, while the artist sits upon a stool by its side.

After a time the Pope called Fra Angelico to Rome, where he lived a part of the last years of his life, painting pictures in the Vatican. Mr. Ruskin has said that Fra Angelico was able to express the sacred affections upon the human countenance as no one else before him ever did. Here is Fra Angelico at his devotions.

sophy, a dandy of theology. He went from town to town airing his knowledge and refuting other teachers. In the height of his fame he fell in love with a girl he was engaged to teach, and married this Héloïse secretly, lest he should be stopped from advancing in the Church. Then his enemies, stirred up by his pride, came about him. He was persecuted, and had on some occasions to flee for his life. He was accused of heresy. St. Bernard was set to dispute with him. The poor old faded monk was bidden to stand in conflict with this great "scholar."

We are told that, hearing the eloquence of St. Bernard, Abelard refused to argue, and appealed to Rome. Rome condemned him. He entered a monastery, sick of the world; his wife went into a nunnery. But his persecutions lasted almost to the day of his death. For Abelard condemned the wicked lives of the monks whose lot he shared, and these men made it hard for him. His reputation as a scholar, however, continued, but he was no longer the swaggering coxcomb seeking to dazzle and attract. He died a broken-hearted man, having spent his last years in writing rather cold and formal letters of religious instruction to his wife in the nunnery. Abelard lived from 1079 to 1142.

THE EXTRAORDINARY STORY OF ST. DOMINIC AND THE BLACK FRIARS

If every person who crosses Blackfriars Bridge in London knew how it came by that name, what a great multitude of people would know the extraordinary story of St. Dominic! The name comes from one of the most striking figures in the Roman Church —a Spanish priest known as St. Dominic. He began life with a beautiful and earnest devotion to Christ. As a boy he prayed often; at the university he sold his clothes in a time of famine to feed the poor, and offered to go as a slave to Morocco in place of a poor woman's brother who had been captured by the Moors. He was ordained a priest, and soon became known for the rigor of his life and the eloquence of his preaching. So far Dominic was simply an earnest son of the Church. But a day came when he went on a mission, and no sooner had he left Spain, where the people feared and obeyed the priests, than he found himself among people of a very different character. Shocked by their disobedience, their heresies, and the manner of their life, Dominic set himself to reform or punish them.

Meeting a magnificent cavalcade from Rome on the same mission, he exclaimed: "How can you expect success with all this secular pomp! These men cannot be touched by words without corresponding deeds. Throw aside your splendor, and go forth as the disciples of old, barefoot, without purse or scrip, to proclaim the truth."

THE POOR MONK WHO FOUNDED THE DREADFUL INQUISITION

Dominic practised what he preached, and became a barefooted, black-robed, mendicant friar—a black friar—and set out to convert these disobedient children. But, alas! success did not attend his efforts, and he had to say at last: "I have spoken to you with tenderness, with prayers, with tears; but, according to the proverb of my country, where the benediction has no effect, the rod may have much. Behold how we rouse up against you princes and prelates, nations and kingdoms, and many shall perish by the sword!"

Some historians have claimed for him the terrible responsibility of having organized the Holy Inquisition—that great organization which tried and condemned men, women, and children in the name of God—but this is doubtful. We know that a man of the purest saintliness, the most devout and simple piety, may become very harsh and stern in the cause of righteousness. Dominic, in addition to this zeal and intemperance, was a man of great genius and much faith. He was born about 1170 and died in 1221.

ROGER BACON, THE ENGLISHMAN WHO WAS SAID TO KNOW EVERYTHING

A great scholar-monk was the English Roger Bacon—"the miracle of the age he lived in." He was said to know everything. He marks for us an interesting place in human history. For many centuries, learning in Europe seemed to be almost dead. But toward the end of the twelfth century a desire for new knowledge awoke, and by the thirteenth century men, no longer content with what had come down from the ancients, had begun to try to search into the unknown. As yet, most of the learned men were in the church, and

thus it was that one of the greatest of the pioneers of science in all Europe was a friar—an Englishman, Roger Bacon. This friar studied chemistry and astronomy, but soon his knowledge gave offence, and he was imprisoned in his friary in Paris. After some time, he was released at the request of the Pope, and was allowed to return to England. But, later on, he was again put under arrest, and kept in prison for the greater part of the rest of his life. He lived from 1214 to 1294.

THOMAS À KEMPIS, THE LITTLE MONK WHO WROTE A FAMOUS BOOK

Early in the fifteenth century, when Europe was in a state of the greatest confusion—England fighting France, and the Turks attacking Hungary, while two Popes, existing at one and the same time, were making havoc of Church government—there lived in a poor monastery in Germany, earning bread for himself and his brother monks by copying religious books, a little man, with soft brown eyes, whose name was Thomas à Kempis.

That name was then quite unknown outside the monastery walls. To-day it is known in practically every language under the sun. The little monk knew nothing of the storm in the world; he was perhaps quite unconcerned as to whether the Pope at Rome or the Pope at Avignon triumphed in the struggle. Such things did not seem to him of much importance. When he spoke of obedience, he did not think so much of temporal rulers and ecclesiastical superiors; he meant the obedience of "the lower part of man's nature to the higher, and of the whole to God."

He was a deeply religious, profoundly pious man, who lived a useful and contemplative life. The noise of cannon and the shouts of kings reached his ears like the sounds of children at play. This quiet and simple little man, besides copying other people's books, wrote some of his own. One of them, called "The Imitation of Christ," which he gave to the world without his name, tells the simple story of the soul in communion with its invisible destiny.

HOW THOMAS À KEMPIS MADE HIS NATIVE TOWN KNOWN TO ALL THE WORLD

But so sweet, so true, so natural, so golden with the breath of a loving, yearning soul is this little book of the little monk, that it has been translated into more languages than any other book in the world except, of course, the Bible.

Little did Thomas à Kempis imagine, while he wrote, that those words of his would become the heart-literature of Europe for centuries. He had been reared in a poor cottage, the son of overworked peasants, and his name of Thomas Hammerken had been changed at school to "Thomas from Kempen," Kempen being the name of the little town where his peasant mother had nursed him. How wonderful is it that this man has sent the name of that humble German town round the whole earth by just writing down, again and again, that he loved God and desired immortal life! Thomas à Kempis lived from 1379 to 1471.

A very famous monk, one of the men who helped to make Florence beautiful, is mentioned on page 2797 of this book. This is the painter known to all the world as Fra Angelico. In books his name is often given as Fiesole, or as Fra Angelico Fiesole. This may seem a little puzzling, but the explanation is simple. His name was Guido—we do not know his other name. When he became a monk, he had to forsake his own name, and take that of Giovanni. Giovanni is the Italian name for John. Whence, then, came the names Angelico and Fiesole? He was born at Fiesole, the little hamlet on the hill above Florence, and he was called the "angelic friar," because of his paintings of angels.

FRA ANGELICO, WHO LIVED A BEAUTIFUL LIFE & PAINTED BEAUTIFUL PICTURES

It was in 1387 that Fra Angelico was born, and when he was twenty years of age he entered the monastery at Fiesole, to devote his life entirely to religion and painting. He painted nothing but religious subjects, and preached beautiful sermons with his brush. His first paintings, as a young monk, were probably done at the city of Cortona, where a number of his pictures are still to be found. In 1418 he was recalled to Fiesole, and labored there until 1436. Then he went down the hill into Florence, to reside in what was then the Dominican convent of St. Mark, but is now a national museum.

Here he executed some of the most famous of his paintings which are still to

be seen. Some remain where he painted them; others have been removed to places more secure. Most of them have been left just as his brush finished them; those which have been "restored," as it is called, have been spoiled. His fame spread, and he was called to do paintings at Orvieto and Fiesole.

Fra Angelico's work at Fiesole is not entirely unknown in England, which is fortunate enough to possess a specimen of it in the National Gallery. It is a magnificent painting of Christ bearing the banner of the Resurrection, attended by a host of saints. This picture serves to show how industrious Fra Angelico was, for in it no fewer than 266 figures of saints are drawn. After he had been nine years at Florence Fra Angelico was summoned by the Pope to Rome. The Pope had heard of the painter's godly life as well as of his work as an artist, and is said to have wished to make him Archbishop of Florence.

HOW THE HUMBLE FRIAR REFUSED HONOR AND DIGNITY

The painter was as modest as he was good and skilful. He prayed the Pope not to make him accept the dignity, and the Pope permitted him to remain a humble friar, and appointed instead a friend of Fra Angelico. In 1445, and again in 1455, Angelico worked in the Vatican. He died in Rome in the latter year, and there he was buried.

There never was a more beautiful life than that of Fra Angelico. He labored with all his zeal for the poor, who regarded him as a brother. He regarded his ability to paint as a gift from God. When he wished to paint he used to kneel and pray. Then he rose and did the work upon which he had set his mind. What he once painted he never altered.

Fra Angelico felt that everything he did as an artist was in answer to his prayers, and that therefore it must stand, as of too holy an origin to be touched up or improved. Religion was to him his hope and joy, and he tried to lead others to share his rapture by the most beautiful paintings of heavenly beings, and by presenting, with all his tender genius, the stories of the Bible. He painted the sorrows of Jesus as well as His triumphs. These were sad days in the life of Fra Angelico, and he would weep bitterly as he painted the Crucifixion.

SAVONAROLA, THE GREAT MONK WHO MADE KINGS TREMBLE

Savonarola is one of the picturesque figures of the Middle Ages. In the midst of that gorgeous, wicked, and careless period, we see the shrunken figure and the gaunt face of a little hooded man, whose glowing black eyes, flashing judgment and anger, glance like lightning on the crowd from under the shadow of his cowl. He was terrible to sin. Rulers feared him, wicked people maligned him, and the populace was swept like a sea by the tempest of his preaching. He came from his monastery to chastise the world. The world accepted the conflict. Savonarola was raised high in honor, then tried, tortured, hanged, and burned. His ashes were thrown into the river.

Such, in brief, is his history. When we look more closely at this great figure we are puzzled by many things. Some people would have us believe that scarcely a greater hero ever crossed the earth; others that he was perhaps the grossest impostor who ever lived. To-day men read history not to take sides in a fight, but to see the truth of things. Savonarola appears to us now a strange mixture of nobility and delusion. We call him a hero, we cannot call him an impostor; but we can criticize him.

He seems to us not a man who sought to deceive, but was himself unconsciously deceived. He believed, for instance, that evil spirits came and wrestled with him in his cell; that the Holy Spirit settled on his shoulder in the form of a dove, and spoke in his ear through the dove's beak; he declared that he conversed with God; he saw visions of the most frightful and appalling description.

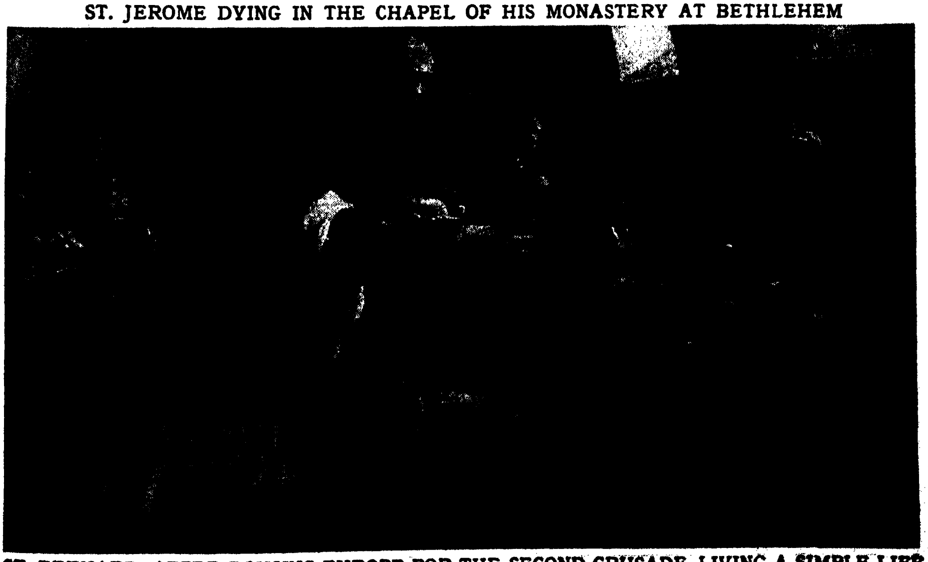
HOW THE SEVERE LIFE OF SAVONAROLA AFFECTED HIS THOUGHT AND ACTION

All this, in our day of calm reason and medical knowledge, assures us that the hero-like soul of this good man was afflicted by the distempers of his brain. The preacher who sways a multitude needs a cool head. The severe discipline practised by Savonarola—his brief hours of sleep, his long prayers, his sparing food, his deficiency of healthy physical exercise—unfitted him for meddling in politics. . He was certainly a very dangerous man.

But his courage was magnificent. His hatred of vice and luxury was most honest. The wickedness of the Court of

THE LAST COMMUNION OF SAINT JEROME

ST. JEROME DYING IN THE CHAPEL OF HIS MONASTERY AT BETHLEHEM



ST. BERNARD, AFTER ROUSING EUROPE FOR THE SECOND CRUSADE, LIVING A SIMPLE LIFE

Rome hurt his noble soul to the quick. If ever a man felt the sharp contrast between the simplicity of Jesus and the magnificence of His Church, it was this fiery prophet of Florence. As he passed to the gibbet on which he was burned—in sight of the beautiful cathedral shown on page 2789, where crowds had flocked to hear his preaching—a bishop said:

"I separate thee from the Church militant and the Church triumphant."

"Not from the Church triumphant," replied the monk, with quiet confidence, "that is beyond your power."

THIS FLORENTINE REMAINED A MONK OF THE ROMAN CHURCH

Protestants have claimed him for a martyr; but he appears to have adored the Sacrament before his death, and to have confessed himself a true son of the Roman Church. Savonarola was born in 1452, and died in 1498.

The famous portrait by a fellow monk, Fra Bartolommeo, is given in the group on page 4029. It was painted from life, and the original still hangs in Savonarola's cell at the monastery of San Marco in Florence.

In 1491 there was born in a Spanish castle a boy destined to become one of the most famous men who ever threw off the world to put on the monk's hood. This was Inigo Lopez de Recalde, known to history by his monk's name and his Roman sainthood, as St. Ignatius de Loyola. He was a nobleman, and grew up on his father's estate without learning of any kind. He became a page in the court of Ferdinand, and, later, embraced the profession of arms. While following the calling of a soldier, he was severely wounded in the right leg at the siege of Pampeluna. While he lay in his father's castle recovering himself of this wound, certain books of religion, given to him to while away his idleness, laid a hold on his soul.

THE SPANISH SOLDIER WHO FOUNDED THE ORDER OF JESUITS

When he rose from the bed it was to journey to a church, where he hung up his soldier's arms, and vowed himself to live a religious life. He removed himself to a hospital, and worked in menial offices to learn humility. Then he journeyed to Jerusalem, and came back inspired with the idea of founding a new religious society. He put himself to school to learn. While learning he began to influence men. Directly he stated his simple views, however, the hand of authority seized upon him, and he had to flee. From city to city he went, begging his way, until at last in Paris he found freedom, and there he lived as a mendicant. At the university his persuasive powers drew certain young men to his side, and at the age of forty-six he was ordained, and set out on his preaching mission.

His burning zeal had drawn around him a remarkable group of men. Six of them met with him in 1534 in the Church of Montmartre and bound themselves to chastity, poverty, and obedience to their superiors. From such small beginnings, made with difficulty and against great discouragement, one of the greatest religious orders sprang.

The miracle of Loyola lies in his creation of the Jesuits, a society spread all over the world, and working in many languages to one and the same end.

For a man who was not ordained until he was nearly fifty, and who was fighting at the age of thirty, this is a most remarkable achievement. Loyola is not responsible for the political power which his society soon gathered. His influence was purely spiritual.

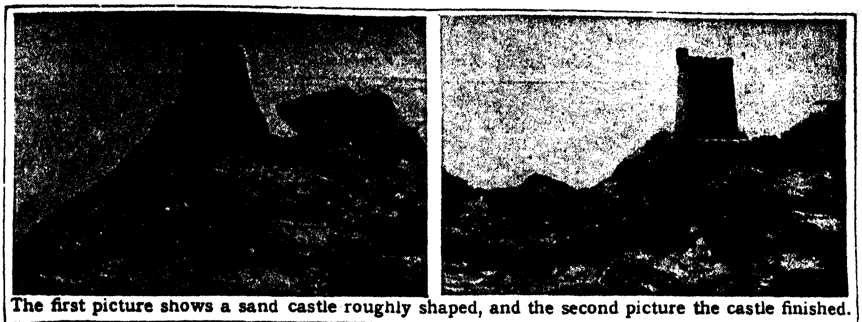
THE WONDERFUL POWER THAT LOYOLA HAD OVER MEN

He drew men to him by the force of his holiness. It is narrated of him that while in Paris he sought to gain the affection of a young student named Xavier, who withstood all his advances.

One day Xavier, having done well in the class for philosophy, was strutting about in great pride, when Ignatius came to his ear and whispered: "What shall it profit a man if he gain the whole world and lose his own soul?" Xavier was converted, and became the famous St. Francis Xavier of the Jesuits. Such was the real power of Ignatius—a personal influence on the side of holiness. Loyola died at Rome in 1556, worn out by his labors and his severe life.

The distinguishing feature of the Jesuit Order is that the members do not retire from the world and shut themselves up within the forbidding walls of a monastery. They are active in the homes of men, in the legislatures of nations, and in the councils of Rome. They are monks of the world.

THE NEXT MEN AND WOMEN BEGIN ON 4099.



The first picture shows a sand castle roughly shaped, and the second picture the castle finished.

BUILDING SAND CASTLES

CONTINUED FROM 3968

ONE of the delights of a holiday spent at the seaside is the building of sand castles on the beach. But we need not be content with what is usually called a castle—that is, a great pile of sand heaped up with little regard to order. We can, with skill and patience, make a really good model of a castle, like that we see upon page 4041.

First of all we must choose a suitable spot, where there is plenty of clean, damp sand, and pile the sand up into a heap something after the shape of the castle we wish to build. To begin with, we can do something simple, such as a round tower, or perhaps a castle gateway. While piling it up, we must beat it well together, so as to make it all as firm and solid as possible; especially must it be well pressed together at the top if we are going to cut out embrasures on the battlements.

If the day is hot, or the sand dry, it will be well to moisten the rough heap, either from a watering-can with a sprinkler or by carefully splashing the water on by hand from a pail or other vessel. The heap must not be wetted too much, or the walls will collapse. After a little practice, we shall be able to judge how wet the sand must be to make it bind well together, but we shall always see signs of too much damp near the foundations first. The heaping up is best done with the spade, and it is well, in the case of a small castle or specially fine work, to pile it on in handfuls, patting it down carefully so that there are no cracks or flaws. Stones, shells, or bits of seaweed must be avoided.

The carving out is roughly done at first until about the right shape is obtained, and then, beginning from the top, the work is finished off till the bottom of the walls and the ditch claim attention.

A small spade can be used for the rough shaping, but the final trimming needs a smaller tool. A kitchen knife is suitable, and with this the sand is literally cut into shape. When using these tools, we must always remember to make a slicing cut, especially when carving near corners, or the edge of the work will be broken away in pieces.

Let us take, as an illustration of the proper methods of sand-working, the building of a tower with battlements. The moulding being done, we first trim off the upper part till it is level all round, and then mark out the top with a knife to show where the openings will come. Having divided it up equally—that is to say, with the openings at regular intervals—we make slicing cuts with the knife, always inwards, to the right depth, and then lift out the cut parts on the knife, thrusting it in from the front. If we do this neatly with a steady hand, those parts of the castle will not need touching again. If, however, pieces are broken away, they can be replaced without much trouble.

When the openings are cut, the battlements must be trimmed to the right thickness, and the centre dug out to form the flat roof. We must do the digging towards the centre, so that no pressure is put on the battlements, or they will be easily broken away. For all digging-out operations, making archways or tunnels, an iron spoon is an invaluable tool.

The battlements being complete, the lower work may now be continued. We cut the walls nearly straight down, roughly at first, and then mark out where the cornice of the battlements will come, for an overhanging cornice adds much to the appearance. The line must be straight, and it is well to use a lath of wood as a ruler if it is at hand; we now cut down at the proper angle, and trim off the sand below, until the walls are even and vertical.

After trimming, the walls will need to be provided with some windows and, perhaps, arrow-slits. We mark out the windows with a point before cutting, so that we can see that they are level and in the right places. If we make mistakes in marking out, the marks can be erased by rubbing with the finger. When ready, they will be

cut in deep and dug out with a knife if small, or with a spoon if large; care has to be taken lest the edges of the opening are broken. Arrow-slits, if small, can be made with the end of a knife dug in deep and moved from side to side before pulling out.

The arched entrance is made in much the same manner as the windows, only, as it will be tunneled in deep, or perhaps right through the wall, a spoon with a long handle will be useful.

If the back of the wall is to be trimmed down or cut thin, it should be done after the front is finished, and probably will need to be done only roughly; but we must be very careful not to be in too much hurry, and trim it off little by little, always letting the pressure of the tool fall on the sand to be removed, and not on the finished work. If all this is done intelligently, it is really quite wonderful what high, thin walls can be made. But do not be too ambitious at first; good stout walls, with one side carefully finished, will be best till practice makes perfect.

If we look at the pictures on the top of page 4039, we can see how the castle appears during the course of construction and when it is finished. The tools can be seen on the right of the first picture—a square of stout cork linoleum picked up on the beach, with which the sand was lifted on to the rock; the end of a small wooden box, also found on the beach, which served as a spade; and a small 4-inch steel rule and a pocket-knife.

When building on rock foundations, several difficulties have to be guarded against. When working with wet sand, the tendency is for the water to filter down to the bottom, especially as the sand is patted and pummeled a good deal, and as it cannot soak away at the base, as is the case when building on a sand foundation, it collects when it reaches the rock, and the mass will divide in two, owing to the sand running away.

To prevent this difficulty, or to remedy it if it arises, several methods are available. If there is any question as to the sand being too wet at the start, it will be well to begin with some fairly dry sand at the foundations, using wetter sand near the top. If, after the work has proceeded some time, there is evidence of the base becoming too wet, take out a few handfuls close to the rock and replace it with drier sand. Another plan is to surround the base with quantities of dry sand, to soak up the water, which can be easily cut away as the work proceeds. Perhaps this last method is the best for a young builder of sand castles.

SOME GAMES PLAYED WITH HOOPS

A HOOP RACE

A WINNING-POST is fixed upon, and all the runners stand with their hoops in a row, waiting for the word to start. Then away they go as fast as they can, bowling their hoops, and the one who reaches the winning-post first with his hoop wins the game. A very good way to add to the fun is for everyone to change hoops just before starting on the race, and to make it a law that the last hoop to reach the goal wins. Each player will try his best to get in front, hoping that the one who has got his hoop will be left behind.

TURNPIKES

IN this game a course is mapped out on the field, and, at certain distances apart, short sticks, with an inch or two of space between them, are stuck side by side into the ground. These are "turnpikes," and if no sticks are handy, bricks or stones may be used instead. The players take hoops and bowl them round the course, steering them through the turnpikes, but should they, in passing on either side, touch one of the pikes, it will count as a mark against them. When the course has been traveled over three times, the number of bad marks against each player is counted, and the one with the fewest marks is the winner. The players must not walk, and should not go slower than a trot.

HOOP PARADE

THIS game might be called "follow my leader with a hoop," and when carefully played makes a pretty pastime for girls or boys. The more that join in it the better the effect. The leader starts off with her hoop at a trot, taking a circular course, and all the others follow behind her. By quickening the speed she presently comes up behind the last girl in the row, and a large ring is thus formed. Then suddenly she turns her hoop to one side and makes another ring, only in an opposite direction, much as we write the figure 8. This may be kept going for some little time, or varied as the leader's ingenuity can suggest. Of course, all who take part in this game should be more or less skilful hoop-bowlers.

HUNT THE STAG

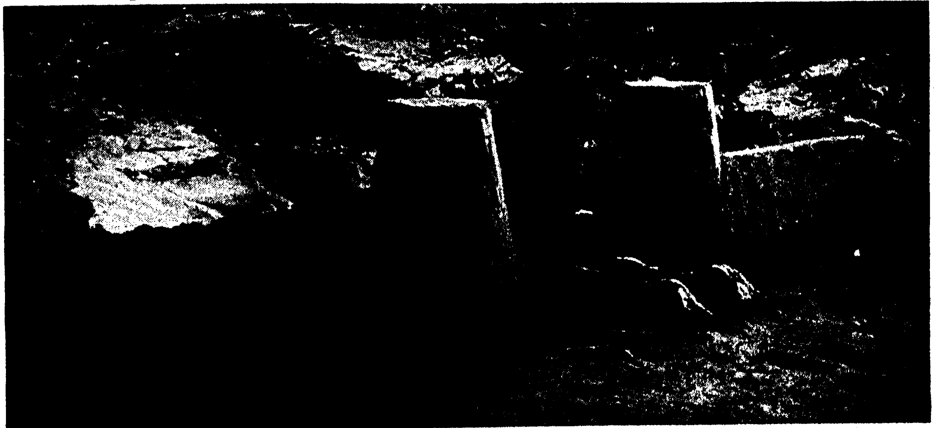
WE want plenty of space for this game and plenty of players. The best runner, who is called the stag, is chosen, and allowed a few moments' start with his hoop. Then away go all the hounds after him, also bowling their hoops, and if the stag knows how to dodge, he may make the others quite breathless before he is caught.

POSTING

THE players stand in a large circle, some yards apart, their separate "stations" being marked by a stick or a stone. Number 1 has all the hoops, and starts the game by running toward her next neighbor, bowling the first hoop as she goes. When half-way she stops, gives the hoop an extra push, and runs back to her station for the next hoop. Meanwhile number 2 has started on with the first, which she bowls to number 3, but she must be back in time to receive the second. Thus, one by one, all the hoops are set in motion, each player running backwards and forwards between her next neighbor and her own station. With care and skill the hoops may be kept going round the circle for some time, but a single mistake means the end of "posting," for where *all* the hoops are in motion it is not possible to make up any lost time.

BUILDING A SAND CASTLE ON THE BEACH

A bucket and spade, a supply of sand, and willing hands with plenty of patience are all that is necessary for the making of a fine castle by the sea. Here we see the builders beginning the walls and towers.



The arch for the gateway is one of the most difficult parts of the building. The sand must be made wet, so that it will " bind," and not fall down upon the garrison, whom we have to imagine as passing in and out.

Patience and skill have at last won a triumph for the bucket and spade ; and here we have the ramparts of a castle. Any number of fairy soldiers might keep guard behind those sturdy walls ; and the little crosses are each the hiding-place of a bowman ready to let fly his arrow at any enemy who may appear.

These three photographs of sand castles and those on page 4025 are by Mr. W. P. Adams.

A USEFUL LITTLE CROCHET PURSE

A SAFETY purse must be used in order to appreciate its usefulness. It is called "safety" because when once the money is dropped in between the chains at the opening, it cannot possibly fall out; it is sometimes worn round the neck on a crocheted chain, and tucked into a fold in the blouse or the belt.

We can, of course, make the purse any size we like. That shown in the picture is a large one, about five inches by three and a half inches. It is made of shaded yellow silk at 15 cents a ball, and crocheted with a steel crochet hook, size No. 3, in the form of a long strip, about one-third of which forms a flap to cover the opening.

We start by making fifty-six chain stitches —if we have not done any crochet work before, we should turn to page 1364—then make three extra chain stitches for the turning, and put one treble stitch into the fourth chain back.

Next we crochet one chain, then put one treble stitch into the next chain below; repeat that into the next chain, again crochet chain, miss a stitch below, and thus repeat one chain two treble to the end of the original chain.

Before turning to work back again, we crochet three chain to form a turning, reverse ends and put two treble into the first large hole below; then crochet one chain over a missed stitch below, and repeat this to the end of the row

We make thirty-five rows like this, and, without breaking off the thread, start making chains along the edge of one end. These chains are for the purpose of closing the purse.

If we make fifteen long chains into loops along one end, and draw the loops through the row of holes lying nearest when the strip is folded up, the ends of the loops can be crocheted into a ring at the back of the purse. Another crochet chain is then put through the ring, and the chain is made long enough so that it will pass over the head and can hang round the neck.

Now to return to our chains. It will help us to strengthen the edge of the opening, if, while making these chains, we crochet along it; so we make two single stitches into the two chain between the large holes, then draw down the thread through the large hole, and at once start making a fifty-six chain. This chain is very simply made—by taking a single stitch through the same large hole, followed by two single stitches into the two chain along the edge.

Having thus made and attached the looped chain, and without breaking off the thread, we fold up the end of the strip with the chains attached and drag these through a row of holes with the crochet hook, the part above the holes serving as a flap to the purse.

Evidently the next thing to be done is to crochet together the doubled-up edge of the strip on the side where the thread now is. That we do by pressing the two edges together between the left thumb and first finger, so that two stitches are side by side, and then crochet single through the two.

At the end we have to break off our thread by making one extra chain stitch, drawing the thread through, cutting it, and pulling it taut. The loose end is drawn through two or three stitches to hide it. We next join the edges of the opposite side, and continue crocheting round the flap to give it a firm edging.

THE CROCHET PURSE COMPLETED

Lastly, we crochet a little chain of suitable length for a ring, join it up, and double crochet into it all round, drawing into each stitch the looped chains until the fifteen are exhausted.

The purse itself is now finished, and all we have to do is to suspend it round the neck by a long crocheted chain.

As this purse is a fairly large one, and quite a small purse may be preferred, a small bag of a useful size may be made on a chain of thirty stitches with three added for turning, and twenty-seven rows for the strip.

Nine looped chains will be sufficient, and the worker will find that after a time it is unnecessary to count the stitches in these; the chains can be measured to the length of the first one made.

It does not particularly matter how long they are; but they certainly must be of equal lengths, and must also be long enough to allow the purse to open wide enough to drop in and take out coins between them. To close the purse after opening it, simply give a tug to the bottom of it.

Peri-lusta can be used instead of the crochet silk. A ball will make two purses, and it is surprising how quickly two little ones can be made. They are sure to please girl friends.

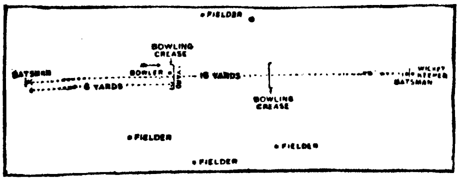
Many people find these purses very useful for carrying gold or silver when traveling.

THE EXCITING GAME OF STOOL-BALL

STOOL-BALL is a delightful game for boys and girls of all ages, and grown-ups enjoy playing it too. It is of old English origin; and many matches are played there each year in September and October. Any good-sized field is suitable for playing in, or it can be played at the seaside on the sands. The outfit for stool-ball is most inexpensive, for we can easily make everything but the ball at home, though spliced bats are very much better than home-made ones, and cost very little. A proper stool-ball outfit consists of two bats, measuring not more than 7½ inches in diameter; a ball, known as Best Tennis No. 3; two wickets, each one consisting of a stake to which a board measuring 12 inches square is mounted. The wickets, when set up, must measure 4 feet 8 inches in height.

Batsman standing ready to take the bowling.

Any number of players may take part in the game, which is really a mixture of cricket and rounders, but six or eight players a side are preferred. To begin the game we set up the wickets 16 yards apart, and mark out two bowling-creases, which must not be over a yard in length, six yards away from each wicket, as we see in the diagram in the centre of this page. This makes the game a very good one for girls, as they have only to bowl 10 yards in order to reach the wicket, instead of 22 yards, as in cricket. Sides having been chosen, we go in to bat two at a time, while the whole of the opposing side goes out



Plan of field, showing arrangement for stool-ball.

Player hitting a catch into the hands of point.

to field, except one player who keeps wicket and another player who bowls.

The bowling takes place from either bowling-crease in alternate overs of eight balls each, the ball being bowled, not jerked or thrown; and the bowler must stand with one foot at least behind the crease, or the umpire will call, "No ball." The umpire calls out "Over" when every eighth ball has been bowled, a "no ball" not counting in an over. The square board is the wicket, not the stake on which it stands. If, in making a run, the strikers have crossed each other, the player who runs for the wicket which is struck by the ball is out. There are five ways of getting out. If the ball, when bowled, hits the face of the striker's wicket; or if the ball, having been hit, is caught in the hands of one of the opposite side; or if, while running, or preparing or pretending to run, the ball itself is thrown by one of the opposite party so as to hit the face of the wicket; or if any of the opposite party, with ball in hand, touches the face of the wicket before the bat of either of the strikers touches the same; or if, with any part of the person, the striker stops the ball which would, in the opinion of the bowler's umpire, have hit the wicket. Another rule to remember is that no stumping is allowed. When we hit a ball, if we fancy there is time to score a run, we must call "Run" to our fellow-player, and run across to the opposite wicket, each touching the wicket she runs to. The non-striker is held to be "out of her ground" unless her bat actually touches her wicket. Any runs made off a "no ball" which touches neither ourselves nor our bat are scored as "byes." If a striker is run or caught out, the attempted run shall

Batsman being run out through misjudging a hit.

not be scored. The umpire's decision must in all cases be regarded as final, and on all points for which there are no special rules, the laws of cricket hold good for stool-ball also. When we really know the game we shall find it quite as exciting as cricket, and there is no danger of being struck by a hard ball.

GAMES PLAYED WITH DOMINOES

UNLIKE chess and draughts, which are very ancient games, dominoes are not known to have been played before the eighteenth century, when it was introduced into France and Belgium from Italy, and later came into England. Dominoes are very popular here, but in no other country are they played so much to-day as in France and Belgium.

A set of dominoes usually consists of twenty-eight pieces, each divided into two parts with so many spots or pips on each, although in the north of England sets are often used that contain fifty-five dominoes, going up to the double nine, and on the Continent it is quite common to go up to the double twelve.

THE BLOCK GAME

THE simplest game with dominoes is known as the block game. The dominoes are placed on the table with their faces downwards and shuffled. Then each player draws one, and when these are turned up the player with the fewest spots or pips is the one to start the game. The dominoes are now shuffled again and each player takes seven pieces, which he looks at, but conceals from the other players.

The first player now puts a domino down, say, the six-five, and the next player has to play a piece with a six or a five on it. This he places against the corresponding number and the next player's turn comes. If the second player puts down a six-three, then the third player would play to a five or a three. Thus the play goes on until a player has used all his pieces, when he wins the game. If there comes a deadlock, and no player can match the numbers that are up, then all the outstanding pieces of the players must be turned up, and he wins who has the fewest pips.

THE DRAWING GAME

THIS game is played in exactly the same way as the block game, except that when a player cannot go, instead of passing he must draw from the unused stock of dominoes until he is able to play. Two dominoes, however, must always be left face downwards on the table and not drawn. In both the games described it is always best to play the high pieces, such as double six, six-five, double five, and so on, first, so that if in the end no one can go, we may have as few pips left as possible.

FIVES AND THREES

ANOTHER interesting and exciting game with dominoes is called Fives and Threes. The pieces are shuffled and drawn as before, but the game is not to get out first, but to make as many fives and threes as possible. For instance, the first player puts down the five-four. This makes nine, or three threes. He scores three points. The next player must play to five or four, but he must try to make the outside numbers add up to multiply by three or five. He plays, say, a four-one to the four, and the outside added to five makes six, or two threes. He scores two. The next player plays to five or one. He puts down the five-one not to the five end, but to the one, and the outside five added makes ten, or two fives; score two. Now, suppose the next player has the double five, he puts it down crosswise, and both sections of the domino count—that is, ten is added to five at the other end, making fifteen. But fifteen is not only five threes, it is also three fives, and so fifteen up scores eight points. Only one other combination will give fifteen, and that is three at one end and double six at the other. Double dominoes are always placed crosswise on the line and the pips on both sections are counted. This is one of the best possible games with dominoes. It is always dangerous to start the game with double six, in case the next player may have the six-three and score eight points.

Two, three, or four players can play at this game, and the number of points to be played up—usually 31 or 61—is always decided beforehand by the players.

THE GAME OF MATADOR

IN this game, instead of matching a number, we have to place down a domino so as to make up the number seven. Thus, if the first player has played the five-two, we must play a piece with a two or a five on it, so as to make a seven with one end of the first domino. Suppose the second player puts down a two-six; the end numbers are now six and two, and the next player must put down either a one or a five to make up seven. When a domino is played that makes a blank at the end, this blocks that end, and only a matador domino can be played there.

There are four matador dominoes, the double blank, and the three pieces that have seven pips upon them, namely, the six-one, the five-two, and the four-three. A matador may be played to any number, even if one of its squares does not make up seven with the last piece played, but the piece played to a matador must make seven in the ordinary way.

As a matador may be played to any number, it is wise to keep our matadors in reserve for a difficulty. In playing this game each player takes seven pieces, but when we cannot go we must draw from the reserve, as in the drawing game.

All these games of dominoes may be played by two, three, or four people, and four may play either as individuals or as partners.

OTHER GAMES

THERE are, of course, variations of these games which are sometimes played. For instance, matador can be played by using five or some other number as matador. If five were taken as matador, then the matador pieces would be five-blank, four-one, three-two, and the double blank; if six were matador, then six-blank, five-one, four-two, and three-three, and double blank would be matador pieces—that is, there would be five instead of four such pieces. Similarly, the game of fives and threes can be adapted to twos and fives or fours and fives, but experience has proved fives and threes to be the best and most interesting combination.

THINGS TO DO IN AWKWARD SITUATIONS

WITH HINTS FOR BOY SCOUTS

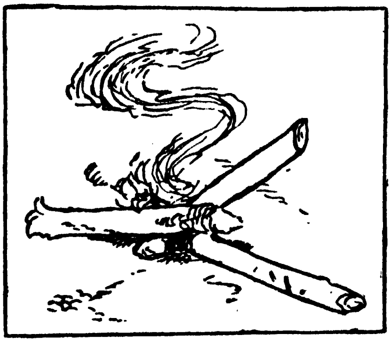
It is essential for any boy who wishes to become successful in life that he should be full of resource, and able to adapt himself to every circumstance in which he is likely to be found. Such resourcefulness is needed not only in boy scouts, but in every boy who does not belong to any organized body of scouts. There are many things that a boy may do when out for a day in the country that will fit him for real scouting and camping work, should the need for such work arise.

TO CARRY WATER

There are various ways of conveying water from one place to another when we have no pails or proper vessels for the purpose. Canvas bags, smeared with grease on the outside, are quite waterproof after they have been soaked for a short time. A basket with oiled cloth arranged inside makes a useful bucket, and if an old cocoanut shell is handy, it may be used for holding water. It is worth remembering that if we are carrying water in pails, some grass picked and placed on the water prevents it splashing. A hole in a leaky vessel may be stopped temporarily with rag or grass well greased over.

TO LIGHT A FIRE

In these days of cheap sulphur matches, there is rarely any need for us to "make fire" when we want to light a fire of wood. But even with matches it sometimes happens that a whole boxful may be wasted on a windy day before the fire can be lighted. It is useful, therefore, to put an overcoat or cloak over our head and over the piled-up wood before we strike the matches, and then, if we have taken the precaution to gather plenty of dried grass and small twigs, we shall have no difficulty in lighting our fire. Wax matches are much better for outdoor use than wooden ones, as the latter get damp in wet weather if they are exposed to the air for long. If we have nothing dry to rub the match upon, we may ignite it by scratching the head of it with the blade of our penknife.



The right way to make a log fire.

FUEL FOR FIRE

It may not always be easy to get wood for fuel, and it is worth knowing that there are various other substances that travelers use for this purpose. Bones of animals are very useful for this purpose, particularly if fresh; but even the bones of cooked meat, if added to a fire, will burn well. The dry manure of cattle, as found upon the ground, is also very useful, and is not at all disagreeable as fuel. If nothing better offers, dried seaweed will burn with great heat, although it does not make a fine cheerful fire. If large logs are being used for fire, two or three of them should be arranged as shown in the picture, the dark ends being the part in the fire. As they burn away they are pushed forward, and so are burned according to a regular system.

TO REST IN A GALE

To lie down and rest in the open air when a gale of wind is blowing, we must not make the mistake of getting under a tree, which provides a good roof high up, but has no wall. What we need is a wall, and a wall about eighteen inches in height will be quite high enough.

This may be provided by turning up the turf if we have a spade, or by piling up stones, or perhaps we may find a little hollow with a natural sheltering wall. In a heavy gale there is always a violent eddy in the neighborhood of a tree, and the result may be seen in a cornfield after a storm, where the corn in the open is unharmed, but that near the tree is all beaten down. It is always warmer to lie down under a cloudy sky than under a clear sky, for the clouds act as a blanket. On sandy plains travelers often keep themselves warm when sleeping at night by burying all but their heads in the sand. The same plan is followed in snowy lands, the snow making a really warm covering and protection from the cold air.

A SIMPLE MATTRESS

When resting or sleeping in the open air, it is as necessary to have something to lie upon as to have proper covering for the body, otherwise the part of the body that is in contact with the earth may get chilled. All kinds of things will provide a useful mattress, and in this matter we may imitate the bird in making its nest. Dried grass, leaves, feathers, heather, wood shavings, bundles of faggots, newspapers, and such material, can be used with advantage, and if the ground is really wet, an excellent bedstead can be made from a heap of stones or a couple of tree-trunks rolled together, if such are available.

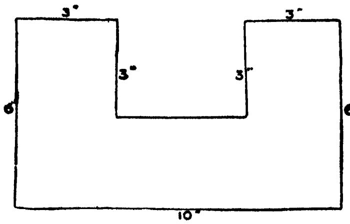
SEATS FOR A MEAL

If we are going to make a stay in one place for any length of time and have no furniture, it is a good plan to dig a trench. This provides both chairs and table, for we can sit on one side of the trench with the feet and legs in the hole, and the other side of the trench makes a handy table. In this way we have a much more comfortable seat than we otherwise should have if we just sat about on the ground or on any odd log that happened to be about.

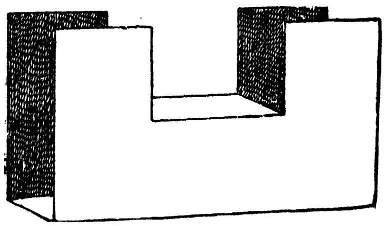
If we are not staying long enough in any place for it to be advisable to dig a trench, we can gather up any dry litter that may be lying about and sit on that.

HOW TO SEE THROUGH A BRICK

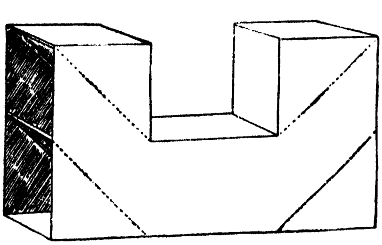
ONE sometimes hears the expression, "I can see as far through a brick wall as anybody else." We shall learn in this article how to make a clever little toy that will enable us to see through a brick, or a book, or a slate, or anything else that is not too large, so that if we hear the expression again, we can tell the speaker that we can teach him how to see quite easily through a brick. We need some pieces of wood—ten in all—about a quarter of an inch thick, and of different sizes. We should see, when we join the pieces of wood together, that all the joints are light-tight—that is to say, that they admit no light. If we do so, the result will be better than it would be if we neglected this point. We cut out two pieces the shape of picture 1, and of the sizes marked in picture 1; then one piece ten inches long and four inches wide, and another piece four inches square. We nail or glue these four pieces together, as seen in picture 2. Now we make and add an upright piece at both ends of the square piece; this will require two pieces of wood four inches long and two and three-quarter inches wide. Then we make two pieces for the top of the box; these will be glass, backs outwards, at the bottom of the box at each end and at an angle of forty-five degrees from the bottom of the box. This is shown in pictures 3 and 4. Now we get two pieces of wood four inches long and three and a quarter inches high, which we put on at each end behind the backs of the lower pieces of mirror. Our toy is now complete, as seen in picture 5; but if we paste colored paper over it right round outside it will improve its appearance, and also help to make it light-proof at the joints. If we place a brick or a book or anything else of a suitable size on the platform in the middle part of our box, we shall find that, on looking in the opening at one end of the box, we can apparently see right through the brick or book. The effect will be more striking if we have a light—say, a window or a candle—opposite the other aperture. Then the light will seem to shine right through the solid brick or the book when we look into the other aperture. The mystery of how this comes about is made clear in picture 6, which shows what happens inside the wonderful box. If we follow the dotted line from the eye through



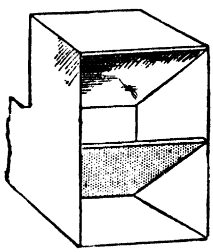
1. Side of the box cut to shape.



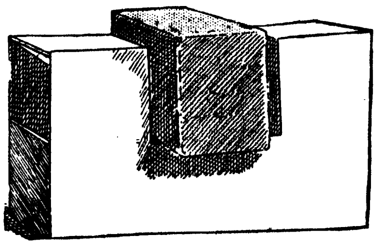
2. Box with bottom and platform.



3. Box after the mirrors are fitted.

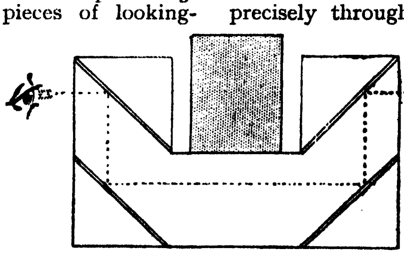


4. End, showing mirrors.



5. Completed box, with brick in place.

four inches long and three and a quarter inches wide. When they have been added to the box, it will be as seen in picture 3. Now we must get four pieces of looking-glass all the same size, four inches long and three and a half inches wide. We fit one piece across the inside corner of the box at one end, as seen in picture 4. This must be put in face outwards and at an angle of forty-five degrees with the top of the box—that is to say, the two side edges of the glass will be at equal distances from the corner. Now fit another piece of mirror in the similar corner at the other end of the box. We fit the other two pieces of looking-the box and out at the far aperture, we can understand how we can see through the brick. The mirrors enable us to see not precisely through a brick, but rather round the brick; but the effect is exactly the same as if we saw through the brick. The whole secret is explained by the words multiple reflection, which means that the reflection of the image is thrown from one reflecting surface, or mirror, to another reflecting surface. Good results are attainable only when the mirrors are placed exactly at the proper angles. Therefore care must be given to the angles at which the mirrors are fixed when the toy is being manufactured.

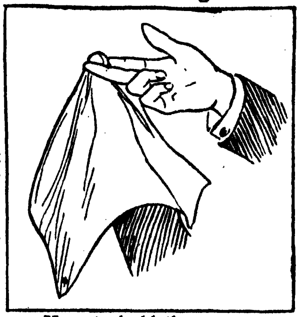


6. Diagram showing the line of vision.

THE COIN AND THE HANDKERCHIEF

THE young wizard will find this a trick after his own heart. It is completely deceptive. It may be exhibited offhand, with any penny, and with any handkerchief. Lastly, it is very easy of execution. Its only drawback is that the necessary movements are a little bit difficult to explain in writing.

The performer begins by borrowing a penny and a handkerchief. A conjurer should always borrow when he can, because anything of his own always lies open to the suspicion, however unfounded, of being in some way specially prepared. Besides, the lenders of the articles used in a trick feel a sort of personal interest in it. In the present case the performer may also ask for the loan of a short piece of string, though there is no objection to his providing this for himself.


How to hold the penny.

Taking the penny in his left hand, and holding it upright between the forefinger and thumb, he throws the handkerchief over it, letting the four corners hang gracefully down around it. "Let us settle it comfortably," he remarks. So saying, he nips the coin through the handkerchief, between the first and second fingers of the right hand, held *palm upwards* as shown in the picture, and tilts it over towards the left.

The forefinger and thumb of the left hand release the coin for a moment, and nip it again by its opposite edge, through the handkerchief. The upright hand is then removed.

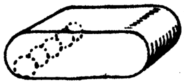
"Now," says the performer, "you would hardly suppose that this simple movement has already caused the coin to vanish. You wouldn't? You are quite right, for here it is still." As if to prove the words that he has just uttered—though nobody in the audience doubts them—he lifts with the right hand the hanging portion of the handkerchief and shows the coin. "Once more we will cover it over." He lets the handkerchief fall around it on all sides. "To make the coin still safer," he says, "I will ask somebody to tie this piece of string round the handkerchief." This is done at a distance of about six inches from the coin. "And now," he continues, "I want the assistance of the strongest gentleman in the company." Someone having volunteered, he says: "Now, sir, I want you to take hold of this handkerchief"—he gives him the hanging portion—"and hold it as tightly as you can. Now you and I will have a little tug-of-war, but in a new way. I am going to try whether I can't pull the penny right through the handkerchief. It is not gone yet, you see." He shows the shape of the penny through the handkerchief. "Now, then, pull as hard as you like! One, two, three!" He himself makes believe to pull with all his might and finally lets go the handkerchief with a sudden jerk, the penny remaining in his hand. The secret lies in the fact that by exactly following the instructions given, which, if followed closely, will be found in practice perfectly simple, complicated as they may look in print, the coin is left, after it has been shown for the second time and the handkerchief let fall around it, in an outside fold, whence, under the pretence of pulling, it is an easy matter to work it out into the palm of the hand.

It is hardly necessary to remark that the trick may of course be worked with a half-dollar, dime, or quarter, just as well as with a cent. Two or three coins may be pulled through the handkerchief at the same time as easily as one when once we have grasped the method to be employed.

THE MYSTERIOUS TUMBLING TABLET

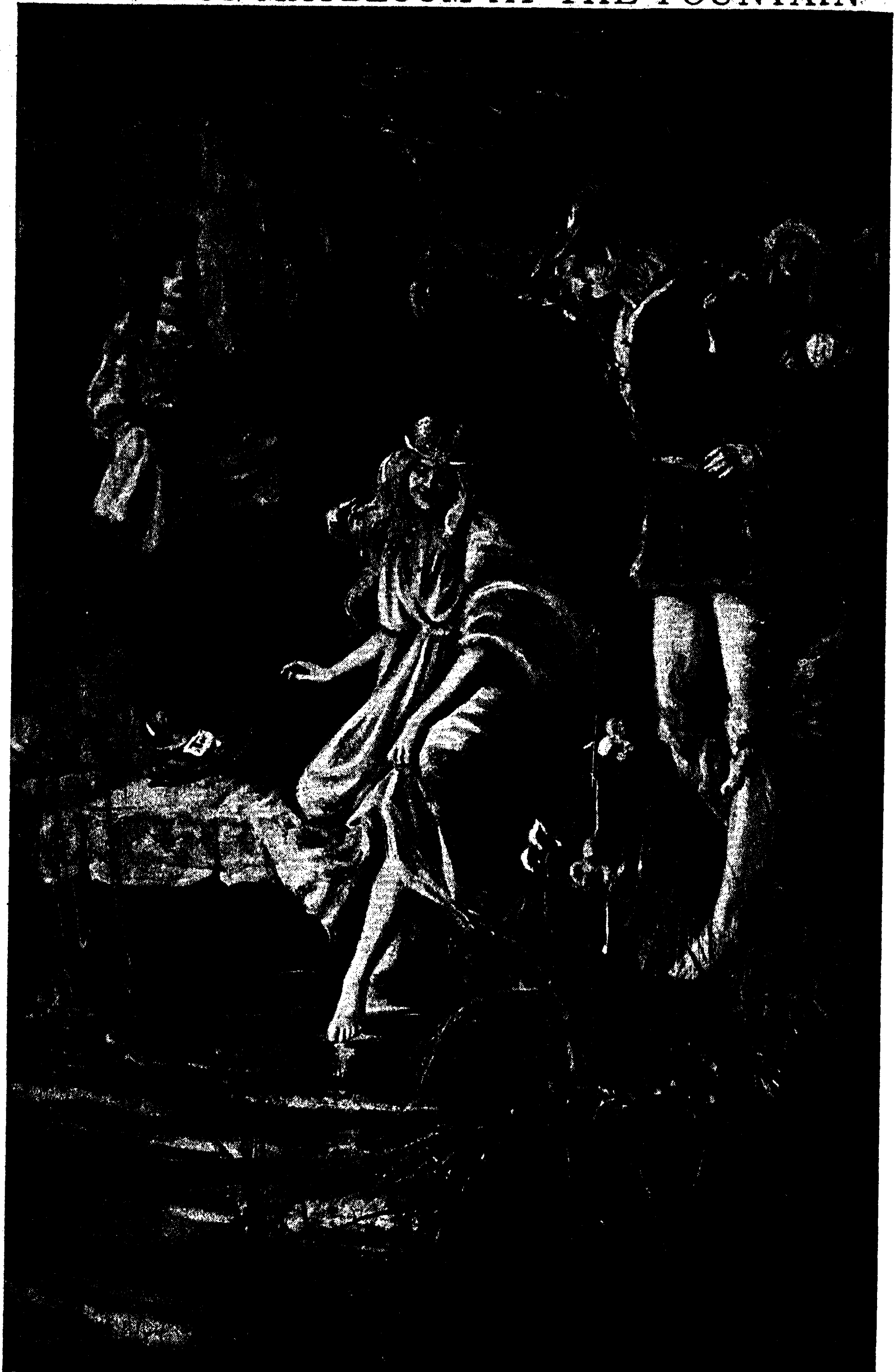
THIS is an amusing little toy that is easily made. We cut two pieces of thick cardboard, one and a half or two inches long and half an inch wide. Both of these we cut at each end to the shape of a semicircle. Now we get a strip of paper—writing-paper will do—one inch wide, and we gum it or glue it round the edges of the two pieces of cardboard, in the position shown in picture 2. That gives us a tiny oblong box, as seen in the picture. But before fixing on the paper as we have already described, we place inside the box a few round lead bullets or large shot, but not more than will lie across the box in one row. Our "tumbling tablet" is now ready to commence its performances. All that is left for us to do now is to place it on any surface with a gentle slope and give it a little start. A tray tilted just a little, or a large book lifted a little higher at one end than the other, will do. Of course, we place the tumbling tablet up at the highest part of the sloping surface. Perhaps it will need a start to go off, and if so we need only roll it over once. Then it will roll over and over down the slope, looking almost as if it were alive. If we are really clever, we can easily understand why it behaves so. The balls or shots roll down the inside of the tablet until they reach the lower end, against which they bump, thereby causing the tablet to turn over. This movement lands the balls at what has become the higher end of the tiny box, and again they roll down and they will repeat the operation time after time, until they come to a stop because the bottom of the slope is reached.


1. Shape of side.


2. Complete tablet.

THE NEXT THINGS TO MAKE AND THINGS TO DO BEGIN ON PAGE 4193.

PRINCESS MAYBLOOM AT THE FOUNTAIN



After traveling for some hours, they reached the place, and Princess Maybloom pulled off her stockings and dipped her feet into the marvelous fountain. The moment her feet touched the water, they grew smaller.

THE STORY OF FAIRYFOOT

CONTINUED FROM 3881

ONCE upon a time there stood far away in the West Country a town called Stumpinghame. Stumpinghame had a king of its own, and his name was Stiffstep; his family was very ancient and large-footed. Great feet had been the fashion there from time immemorial, and the higher the family the larger were they. His queen, Hammerheel, was the greatest beauty in Stumpinghame. Her Majesty's shoe was not much smaller than a fishing-boat; and their six children promised to be quite as handsome, and all went well with them till the birth of their seventh son, when it was whispered throughout the city that the queen's seventh child had been born with such miserably small feet that they resembled nothing ever seen or heard of in Stumpinghame, except the feet of the fairies.

The king and queen were so ashamed of him that the young prince was sent secretly out to the pasture lands, to be brought up by the shepherds. The chief man there was called Fleecefold, and people came from all quarters to see the young prince.

The king and queen had given him fourteen names, beginning with Augustus; but the honest country people could not remember so many; besides, his feet were the most remarkable thing about the child, so with one accord they called him Fairyfoot. He was a handsome boy, but the news of the court traveled to the shepherds, and Fairyfoot was despised among them. Fleecefold was ashamed to have him in his cottage, and as soon as he was old enough, Fairyfoot was sent every day to watch some sickly sheep that grazed on a wild, weedy pasture, near the forest.

Poor Fairyfoot, who was often lonely and sorrowful, was lying in the shadow of a mossy rock one warm summer noon, when a robin, pursued by a great hawk, flew into the old velvet cap which lay on the ground beside him. Fairyfoot covered it up, and the hawk, frightened by his shout, flew away.

"Now you may go, poor robin!" he said, opening his cap; but instead of the bird, out sprang a little man dressed in russet brown, looking as if he were a hundred years old. Fairyfoot could not speak for astonishment, but the little man said:

"Thank you for your shelter, and be sure I will do as much for you. Call on me if you ever want help; my name is Robin Goodfellow." And, darting off, he would have been out of sight in an instant had not Fairyfoot jumped up and called him back.

"What is it?" said the little man.

"I am very lonely, and no one will play with me, because my feet are not large enough," said Fairyfoot sadly.

"Come, then, and play with us,"

said the little man. "We lead the merriest lives in the world, and care for nobody's feet; but there are two things you must mind—first, do as you see the rest doing; and, secondly, never speak of anything you may hear or see."

"I will do that, and anything more you like," said Fairyfoot. Then the little man, taking his hand, led him over the pasture into the forest, and along a mossy path among old trees wreathed with ivy, till they heard the sound of music, and came upon a meadow where the moon shone as bright as day, and all the flowers of the year bloomed together in the thick grass. There was a crowd of little men and women, some clad in russet color, but far more in green, dancing round a little well as clear as crystal. And under great rose-trees, which grew here and there in the meadow, companies were sitting round low tables covered with cups of milk, dishes of honey, and carved wooden flagons filled with clear red wine.

The little man led Fairyfoot to the nearest table and bade him drink. Immediately the red wine touched his lips, all his troubles seemed to leave him, and the little people about the well cried: "Welcome! welcome!" and every one said: "Come and dance with me!" So Fairyfoot was as happy as a prince, and drank milk and ate honey till the moon was low in the sky; then the little man took him by the hand and led him back to his own bed of straw in the cottage corner.

Next morning Fairyfoot was not tired for all his dancing. Nobody in the cottage had missed him, and he went out with the sheep as usual; but every night all that summer, when the shepherds were safe in bed, the little man came and took him away to dance in the forest.

The wonder was that he was never tired or sleepy, as people are apt to be who dance all night; but before the summer was ended, Fairyfoot found out the reason. One night, when the moon was full, Robin Goodfellow came for him as usual, and away they went to the flowery green. The fun there was high, and Robin was in haste. So he only pointed to the carved cup from which Fairyfoot every night drank the clear red wine.

"I am not thirsty, and there is no use losing time," thought the boy, and he joined the dance; but never in all his life did Fairyfoot find it such hard work to keep pace with the company. Fairyfoot did his best, but at length he was glad to steal away, and sit down behind a mossy oak, where his eyes closed for very weariness. When he awoke, the dance was nearly over, but two little ladies clad in green talked close beside him.

"What a beautiful boy!" said one of them. "What handsome feet he has!"

"Yes," said the other, "they are just like the feet Princess Maybloom had before she washed them in the Growing Well, which has now dried up. Nothing in this world can make them small again, you know."

When they were gone, Fairyfoot could sleep no more for astonishment. It amazed him that Princess Maybloom's father should be troubled at hers growing large. Besides, he wished to see that princess and her country. All that day he was so weary that he got into sad disgrace with the shepherd for neglecting his sheep. The old man beat him so cruelly that he determined to run away.

So on and on he ran, far into the forest, until at last, utterly exhausted, he sank down at the foot of a tree and fell fast asleep. When he awoke, he heard voices.

"What boy is this?" said a nightingale on a branch above him. "He cannot have come from Stumpinghame with such small and handsome feet."

"No," said another; "he has come from the West Country. How in the world did he find the way?"

"How simple you are!" said a third nightingale. "What had he to do but follow the ground-ivy which grows over height and hollow, bank and bush, from the lowest gate of the king's kitchen-garden to the root of this rose-tree?"

Fairyfoot was greatly astonished at this conversation, and thought it might be as well for him to follow the ground-ivy, and see the Princess Maybloom. It was a long journey, but he found the gate at last, and walked through the garden, till a white fawn came frisking by, and he heard a voice saying sorrowfully:

"Come back, come back, my fawn! I cannot run and play with you now, my feet have grown so heavy." And, looking round, he saw the loveliest young

princess in the world, dressed in snow-white, and wearing a wreath of roses on her golden hair. At once he guessed that this must be the Princess Maybloom, and made her a very humble bow.

"Royal princess, I have heard of your trouble because your feet have grown large, and I know of a certain fountain in my country that will make them smaller and finer than ever they were," said he.

When the princess heard that, she danced for joy in spite of her large feet, and she and her six maids brought Fairyfoot before the king, who consented to allow the princess to accompany Fairyfoot to the marvelous fountain.

After traveling for some hours, they reached the place, and, sitting down, Princess Maybloom pulled off her stockings and dipped her feet into the fountain. The moment her feet touched the water, they grew smaller, and when she had washed and dried them three times, they were as small and finely shaped as Fairyfoot's. There was great joy among the company, and the princess thanked Fairyfoot again and again.

Just at that moment they heard a sound of music, and Fairyfoot knew it was the fairies going to their dancing-ground. Rising quickly, he took the Princess Maybloom by the hand, and all followed the music through the forest. At last they came to the flowery green. Robin Goodfellow welcomed the company for Fairyfoot's sake, and gave everyone a drink of the fairies' wine. So they danced there from sunset till the grey morning; but, before the lark sang, Robin Goodfellow took them all safe home.

There was great joy that day in the palace because Princess Maybloom's feet were made small again. The king gave Fairyfoot all manner of fine clothes and rich jewels; and when they heard his wonderful story, he and the queen asked him to live with them and be their son.

In the course of time Fairyfoot and Princess Maybloom were married, and they both lived happily ever after.

THE DOG THAT KNEW HIS MASTER

A TRUE TALE OF A SCOTTISH COLLIE

GOILA was a Scottish collie, born on a sheep-farm near the picturesque banks of Loch Goil. Hence the name by which, by a child's happy freak, he was called. His parents were of high degree on both sides, and had won prizes on the show-bench and in the trial-field.

When full grown, Goila was a perfect type of animal grace. The head was poised on a long, arched neck; the back broad, with an upward curve in the loins; the quarters muscular; the shoulders well set back and powerful; the legs rather high and never tiring; the body, except the deep chest, which boasted a snow-white "shirt-front," was covered with the glossiest blue-black coat, which one could feel was impenetrable to the sharpest cold; and the tail was large and bushy—a true flag-signal in frolic, peace, or war.

But it was the head itself which won love and admiration: a broad skull, flanked by small, forward-drooping ears when quiet, but instantly erect when alert; the muzzle was smooth, fine, and tapering, and a white line ran down the forehead; the eyes were full, bright, expressive, spirited, and intelligent. Goila grew up more than a pet. With the children he was a comrade in fun and play; with the head of the household he was a friend and companion in the best sense of the term.

Early in puppyhood, Goila showed musical tastes. In the parlor was an upright piano, and it was noticed that Goila, if he possibly could get access to the room, lay beside the pedal just below the keyboard.

By and by, as his musical education progressed, so did his likes and dislikes in harmonies.

When some compositions were being played, he became almost frantic, running round the room, barking angrily. Others seemed to please him; and he would crouch down on the carpet and emit a prolonged cry, which rose and fell with a distinct cadence. He was a loyalist: he invariably joined in with fervor, and not out of tune, when the children sang "God Save the King."

One day, when it was known that there was no person in the parlor, notes were heard coming from the piano

as if someone were striking the keys at random. When the door was opened, Goila was found standing on his hind legs, with his two fore-paws pressing here and there on the keys, the response from which was evidently to his intense delight. The hint was enough.

The children taught him, with assistance, of course, to pick out "Haydn's Hymn" not at all badly. He was a religious doggie, as he never ventured to utter a note during the Sunday evening hymn. But the greatest fun was when a German band came round to the street. The moment Goila heard the toot-toot, he ran to the band with the keenest enjoyment. He jumped round the somewhat resentful musicians, howled and pranced approval or otherwise, and if, perchance, which was often the case, an inexpert or careless instrumentalist played a wrong note, Goila rushed at his heels. In fact, he became so unwelcome a critic that the band very soon ceased to come to the street.


THE DOG STOPPED AND PRICKED HIS EARS

He had social instincts. His most curious friendship was that with a tortoise. When the tortoise became accustomed to the dog, it put out its head from its shell, and allowed Goila to lick it. There was a step leading from the kitchen to the scullery, and another from the scullery to the back garden. When the tortoise wished to take its walks abroad, Goila would carefully assist it down the steps, and watch it with curious interest searching for and eating lettuce. But Goila's love for his mailed friend was the undoing of the latter. When autumn came, the tortoise dug a hole in the garden soil in which to sleep through the winter. Goila smelt him out, and excitedly rescued his friend from premature burial. From cold and want of his winter sleep the tortoise died.

Goila was a wonderful retriever either of children's boats or caps on the lake, or of articles artfully hidden in holes or beneath stones. He had cunning distinctions as to what was fair game. Early in the morning after a first day's stay in the schoolhouse of a Highland village, Goila was found to have brought to the kitchen door a rabbit and a partridge. We wished to live at peace with the gamekeeper, and solemnly admonished Goila never to bring in another bird; we soothed our conscience by telling the dog that rabbits were vermin. Never another bird was found on the doorstep; but, truth to tell, there was occasionally rabbit-pie for dinner.

How long does a dog's memory remain fresh? It is hard to say. The writer had occasion to go abroad. Although Goila was supposed to be locked up when he left home to take the train for London, the dog came tearing along the departure platform as the guard gave the signal for the start, and was last seen galloping at a great speed and howling furiously as the train disappeared in the darkness of the night. Some days afterwards he returned home, footsore and with a ragged coat. The dog was disconsolate; he lost all interest in his old home and its inmates, and after a few weeks disappeared. Seven years elapsed, and the writer returned to Scotland. One afternoon, a month afterwards, in the southern district of his own town—Edinburgh—he saw Goila trotting at the tail of a butcher's cart. Merely on the offchance of a recognition, he called out: "Goila!" The dog stopped, pricked up his ears, gave a wild yelp of delight, circled round and round, leaped up with his fore-paws on the shoulders, and licked the dearly-loved face of his old master.

But the new joy was very short-lived. Before many months had gone Goila had again disappeared, as if it had all been a dream; and, despite every inquiry by advertisement and otherwise, he was, to our great sorrow, heard of no more.

UNDINE, THE STORY OF A WATER NYMPH

ONCE upon a time, many years ago, there lived an old fisherman and his wife. They were lonely people, for their bit of land lay upon the edge of a large lake, while back of it stretched an enchanted forest through which lay the road to the market where the old man sold his fish. To their great joy, it came to pass that a child was born to them, a beautiful little girl. One day as the mother sat by the edge of the lake, her baby in her arms, the child, attracted by some beautiful thing in its clear depths, leaped forward into the water, sank instantly below its surface and was gone. That same evening, while the parents were mourning the loss of their child, a tap came at the cottage door and a lovely little girl about three or four years of age stood upon the threshold.

The fisherman and his wife took her in gladly and brought her up as their own daughter. When the girl was about eighteen years old, there came through the enchanted forest to the old fisherman's hut a wonderful knight named Huldbrand. He had made his way through the gloom and mysteries of the forest with great difficulty. Horrible little dwarfs had tried to frighten him away; a great tall man, with flowing robes, had continually blocked his path.

Hardly had the knight reached the shelter of the cottage when a great storm came up which lasted several days. The waters of the lake rose to such an extent, that the little promontory where the old couple and their foster daughter lived became an island and all passage out into the world beyond was cut off. During this time the lovely Undine and the handsome knight were very much together, and became very fond of each other.

One night while the storm was still raging, a priest, who had been driven to their shore by the fury of the waves, sought the protection and shelter of the little cottage. The good father soon became aware of the attachment of the young couple, and before the evening was over it was arranged, much to the joy of her foster-parents, that Undine and the knight should be joined in holy wedlock.

Now it happens, as perhaps you've heard, that the air and elements among which we live are inhabited by beings as wonderful as ourselves, and far more beautiful. Especially are the seas and rivers, and even the little brooks, full of these lovely beings, so like us but with this great difference, that they have no souls. Therefore, when they die they vanish into dust, leaving no trace behind, and have no hope of a more beautiful after life. To find a soul it is necessary for one of these lovely creatures to become united to one of our race, and it was for this purpose that Undine's father, a great prince of the Mediterranean Sea, had sent his little daughter to the fisherman's cottage that night so long ago.

When Huldbrand became aware of this fact he was at first dismayed, but Undine was so lovely, and indeed since the night of the wedding so changed, so gentle, so biddable, that he dismissed his fears, and clasping her to him, vowed eternal love and protection. The morning after the wedding found the sun shining gloriously and the waters so far receded that there was no longer need of delay. So, accompanied by Father Heilmann—Undine mounted upon the knight's horse, Huldbrand walking at her side—they started back through the enchanted forest.

The sudden departure and long disappearance of the young knight Huldbrand had caused great consternation among his friends in the royal city, and great, therefore, was the rejoicing at the return of the knight, accompanied by his beautiful bride. There was one, however, who could not rejoice. This was Bertalda, foster-child of the Duke and the Duchess of the imperial city; for she it was who had sent the knight into the enchanted forest as a test of his love for her. So there was, as you can see, nothing but jealousy in her heart for the young bride who had won his love at the other end of the dark forest. For Bertalda, however, Undine soon felt the greatest affection, and when she discovered from her uncle Kühleborn, a powerful water sprite, who inhabited the waters of that region and with whom she had frequent intercourse, that Bertalda was not other than the lost daughter of the old fisherman and his wife, her joy knew no bounds.

Thinking in her innocent heart to give

a delightful surprise, she planned a dinner, at the end of which the secret of Bertalda's birth, which up to that time had remained a mystery, was to be revealed. At the appointed time the old fisherman and his wife were led into the dining hall and Undine, with every mark of affection and delight at giving so much happiness, proclaimed them Bertalda's long lost parents. Bertalda, however, who never for an instant had dreamed but that some lady of high rank would claim her as her child, was enraged at what she considered an attempt to humble her in the eyes of Huldbrand and all his guests. She treated the poor old couple so discourteously that the Duke and Duchess withdrew their protection and her own parents refused to accept her as their child until she should show a change of heart, and in habit befitting her lowly birth come to them alone through the enchanted forest as proof of her regard.

Feeling that the disastrous results of her plan must have made the city forever distasteful to Undine, Huldbrand decided to start the next morning for Castle Ringstetten, situated near the source of the Danube River. As they drove out of the city they encountered Bertalda in the costume of a fisher-maiden, forsaken by every one, trying to sell her fish as means of a livelihood.

At sight of Bertalda's misfortune, Undine was full of sympathy and would hear of nothing but that Bertalda should accompany them on their journey and that they should share all things as sisters in love and affection. For a time all went well at Castle Ringstetten, but gradually Bertalda lost her suddenly acquired humility; she became again the proud and haughty lady, and encouraged by the admiration which Huldbrand no longer strove to conceal, she frequently assumed the position which Undine as rightful lady of the castle should have held. Kühleborn, ever watchful for the welfare of his niece, became aware of her unhappiness and by his frequent visits and sudden appearances in the castle frightened Bertalda and added to the knight's growing aversion to his gentle wife. At last, in order to prevent the reappearance of her mysterious relative, Undine ordered the great fountain in the courtyard of the castle to be sealed up. For a time again all went well, Huldbrand felt a return of affection for his trusting wife, and secure in their new found happiness, Undine suggested a much talked of trip down the Danube as far as Vienna. Bertalda of course was to accompany them and they began to plan their journey with great delight.

Undine had often warned her husband against showing any trace of anger or displeasure toward her while on the water, but no sooner had they entered the domain of the watchful Kühleborn than they were tormented by his impish tricks. Undine had constantly to rebuke him for his insolence and their pleasure was completely spoiled. Kühleborn's mischievous pranks became more and more violent, until in a flash of rage, Huldbrand commanded his trembling wife to return to her mysterious kindred of the sea and trouble him no more. In the greatest distress Undine began to weep. "Alas," said she, "farewell. They shall do you no harm, only remain true so that I may be able to keep them from you. I must, alas, go away! Oh, woe, woe, what have you done! Oh, woe, woe!" She vanished over the side of the vessel and disappeared from sight, but it seemed as if the little waves kept saying, "Oh, woe, woe; remain true; woe, woe!"

The Lord of Ringstetten and Bertalda returned alone to the castle and for some time lived in mourning and great sorrow, thinking only of their love for Undine and forgetting entirely their feeling for each other. But as often happens, gradually the knight's sorrow grew less. He thought less often of Undine and more often and with still greater fondness of Bertalda. At last the nuptial day was set, and Father Heilmann was summoned to perform the ceremony. Upon receiving the summons, the priest immediately set out for the castle, not indeed to perform the marriage rite, but if possible to prevent it, for Undine had appeared to him in a dream imploring him to prevent the marriage, and thus to save Huldbrand's life, for she was still alive. In spite of Father Heilmann's advice, preparations for the coming festival went on according to arrangement, and indeed, all might have been well had not Bertalda bemoaned the fact that the fountain, from which such healing waters used to flow, had been sealed up. One of her maidens, hoping to please her new mistress, hastened to summon attendants

to lift the stone from the fountain. The task proved an easy one, for scarcely had they touched it when, as if impelled by some hidden power, the great stone rolled away, and from the opening of the fountain rose a female figure draped in white. Weeping bitterly and wringing her slender hands, the sorrowful figure glided silently through the courtyard and up the stairs to the knight's own room, where he stood lost in gloomy melancholy.

He was pondering in his heart the meaning of a dream he had had the previous night. It seemed to him a dream, but his spirit had in reality been translated to the Mediterranean Sea, where Undine now dwelt. He could see her sitting beneath a crystal arch weeping bitterly. Presently her uncle Kühleborn approached her and, as if to warn him anew, they talked of the danger he would incur by leaving his castle or opening the fountain, should he indeed marry Bertalda. "But," said Undine, "I have prevented that, for he is now in spirit hovering over the sea, listening to our conversation, and he will remain true to me." And ever and anon through his dream floated the exquisite music of the Swan Song, symbol of death.

But now, in spite of all warning, he had broken his vow of faith and love and Undine had been sent to perform her mournful task. "They have opened the spring and you must die," she said very gently. Paralyzed with terror and the certainty that his end had come, Huldbrand nevertheless felt his breast swell once more with love for this beautiful creature, for raising her veil, Undine appeared before him fair as when he had wooed her beyond the enchanted forest.

Drawing him to the couch, she laid her head against his breast and encircling him with her arms she wept and wept until he, too, began to weep, and finally exhausted sank back upon the pillows dead. "I have wept him to death," she said to a group of maidens as she passed.

They buried him in a little country churchyard near the castle. In the funeral procession was a white-robed figure that wept unceasingly. When the mourners knelt, it knelt too, but when the rest arose, the white figure had vanished and in its place gushed forth a little silver streamlet that gradually encircled the knight's grave and continues to do so this very day.

LA PLUS SAGE FILLE DU WESSEX

THE ENGLISH VERSION OF THIS STORY IS GIVEN ON PAGE 2316

Il y avait autrefois un Roi de Wessex appelé Ina. Il était grand, brave et beau, mais avait un grand défaut. La moindre des choses le vexait et le mettait dans une colère terrible. Le sachant, il décida d'épouser une fille sage qui pourrait le calmer et le diriger. Une après-midi, il quitta Winchester et alla dans la grande forêt, à cheval. Ayant soif, il s'arrêta à la cabane d'un bûcheron pour boire du lait. La jolie fille du bûcheron lui apporta du lait et quand il lui rendit le gobelet, il lui dit :

"Je suis le Roi de Wessex, Ina. Videz toutes les mers du monde avec ce gobelet et je vous ferai ma Reine."

Edith entra dans la cabane, en ressortit avec une poignée d'étoupe et la tendant au Roi Ina, elle s'écria gaiement :

"Barrez toutes les rivières avec cette étoupe et j'obéirai à votre désir."

"Vous êtes celle que j'ai cherchée," dit le Roi Ina.

Et il la mit sur son cheval et la conduisit à son palais de Winchester. Mais juste avant le mariage, Edith lui dit :

"Vous savez que vous avez l'humeur ombrageuse. Promettez-moi donc, si vous vous fâchez avec moi et me chassez du palais, de me laisser emporter un cadeau d'adieux."

Le Roi Ina y consentit, naturellement. Comme ils étaient à souper, un soir, Ina fut offensé par un bon conseil que sa femme lui donna, et s'écria :

"Vous vous mêlez trop de mes affaires. Demain, vous retournerez avec votre père à votre cabane."

Quand son mari eut le dos tourné, elle versa une potion dans son breuvage, ce qui le fit s'endormir. Ensuite, elle le fit transporter doucement à la cabane dans la forêt.

"Qui m'a conduit ici ?" cria-t-il en s'éveillant le lendemain matin.

"C'est moi, chéri," dit la Reine Edith. "Vous êtes mon cadeau d'adieux."

"Ah !" dit le Roi Ina en l'embrassant, "j'ai eu raison d'épouser la plus jolie fille du Wessex, et aussi la plus sage !"

THE FABLES OF ÆSOP THE SLAVE

THE PEACOCK AND JUNO

A PEACOCK, feeling one day very discontented, said to the goddess Juno: "Why did you not give me such a good voice as the nightingale? Everyone is pleased to hear its voice, whereas I am laughed at for the ugly screaming noise that I make."

Juno, who was very much concerned at the discontent of her favorite bird, replied:

"True, the nightingale has a fine voice, but you have the advantage in your beauty and elegance."

"But what is the use of my silent beauty, when I have such a poor voice?" demanded the peacock.

Juno dismissed him, saying:

"Each creature has some of the good things of Nature. This one has beauty, that one a glorious voice, another strength, and so on, and each should be content with its particular quality."

Be content with what you have.

THE FOX AND THE FROG

A FROG one day told the various animals in the forest that he was able to cure all kinds of illness. He spoke in a hoarse croak that was little understood, and the animals therefore admired his learning, and believed what he said. A fox, however, who happened to be passing at the time, said, with indignation:

"How can you have the impudence to offer to cure others, when you have such an ugly spotted body and horrible croaking voice?"

People should cure their own faults before finding faults in others.

THE HEN AND THE FOX

A HUNGRY fox went into a fowl-house in search of something to satisfy his appetite. He saw, sitting on a perch, a fat hen; but, try as he would, he was unable to reach her. At last he thought of trying to make her descend from her position.

"Cousin hen," said he, "I heard that you were ill, and so I have come to inquire how you are now. Come down, and I will feel your pulse, and tell you what to do to get better."

"True, I am not feeling very well," answered the hen; "but I am sure that I should catch my death if I happened to come down from this cosy perch."

Flattery is the last resort of fools.

LE ROI, LE NOBLE, ET LE PAYSAN

THE ENGLISH VERSION OF THIS STORY IS GIVEN ON PAGE 3711.

LOUIS XII. de France apprit un jour qu'un certain noble avait très brutalement châtié un paysan. Comme le Roi était appelé le "Père du Peuple," et était vraiment adoré de tous ses sujets à cause de sa bonté de cœur, on peut s'imaginer combien il dut être irrité et désolé. Il résolut de donner au noble une leçon sur la façon de traiter ceux qui étaient moins fortunés que lui, mais il ne révéla pas son plan. Pendant plusieurs semaines il réfléchit et à la fin il trouva un plan qui, selon lui, devait être excellent.

Un jour, il invita le noble à son palais et le garda à dîner. Il ne dîna pas avec son hôte, mais fit servir au seigneur un banquet magnifique. Tout ce qu'on peut imaginer de meilleur à manger fut servi, excepté du pain, car le Roi avait donné l'ordre absolu que l'on ne serve pas de pain. Le noble fut naturellement surpris par cette omission, mais, par courtoisie, n'osa pas demander une chose aussi petite et commune, en présence de tant de mets rares et délicats. Mais de plus en plus il sentit le manque de pain, tant que vers la fin du repas, il était presque enragé par l'absence d'une chose aussi nécessaire.

A ce moment le Roi entra.

"Monsieur," dit le Roi à son hôte, "vous a-t-on servi un bon repas?"

"Sire," répondit le noble, "on m'a servi un festin superbe, un festin de Roi. Et cependant, pour dire à Votre Majesté toute la vérité, il me semble que je n'ai pas bien dîné; car, pour vivre, le pain est nécessaire, et il n'y avait pas de pain à ce banquet."

"Allez," dit Louis XII., sévèrement; "et comprenez bien la leçon que j'ai désiré vous donner. Puisque vous avez besoin de pain pour vous satisfaire, apprenez à traiter plus humainement ceux qui travaillent pour le faire pousser, afin qu'on vous le serve."

THE NEXT STORIES ARE ON PAGE 4123.

A Canoe and Totem Poles from Alaska

THE MOST NORTHERN TERRITORY

CONTINUED FROM 3921

PEOPLE of warmer climes sometimes think of Alaska as a raw, rough country, a country of rugged mountains and barren snow-covered plains, a country of short summers and bitter winters, a country with little pleasure and abounding peril. Some novelists have written as though all the men were creatures of the wild, with primitive wants and passions,—savage creatures with savage loves and hates, whose lives were a perpetual struggle with cold, and hunger. This is not the real Alaska, of which we shall try to tell you something.

WHERE THE STORY OF ALASKA REALLY BEGINS

Through the first years of Alaska's history, no one even guessed the riches that lay buried in the heart of this great white land of the North. The story of Alaska really begins with the days of Peter the Great of Russia. It was a time of great excitement throughout Europe, for Guillaume de Lisele, First Geographer to the King of France, had just given to the world a new map showing a great unexplored country between Asia and America. It was reported that this land was one of fabulous wealth, a veritable Eldorado. France and Spain at once sent ships sailing over the seas to explore and claim the new country for their respective sovereigns.

Wonderful tales of the northwestern land drifted to the ears of Peter, Czar of Russia, and he too resolved to add it to his empire. He planned an expedition in charge of Vitus Bering, a Danish navigator, in his service. It failed so completely that Bering returned to Russia convinced that "though there was such a country on the maps, there was none in the sea." But the wise Peter and his councillors would not listen to Bering, but persisted in sending him out for another trial.

In 1741, Bering sailed once more. For days at a time he was enveloped in an impenetrable fog, and at last he gave up hope and ordered his ship to turn its head homeward. As he did so, behold! the fog lifted and driftwood and seaweed and birds appeared, and before them lay a great land, and a great peak lifted its giant head into the clouds. And because it

was St. Elias' day, they called the peak Mount St. Elias. Bering himself was wrecked, and no white settlement was made for more than forty years.

THE PURCHASE OF ALASKA BY THE UNITED STATES

The land seemed bleak and bare, with but few natural resources. A few fur traders wandered over the waste, and Sitka was for a while a considerable town, but furs became scarcer. Finally, Russia needed money, and, in 1867, sold this great tract of wilderness to the United States for the sum of $7,200,000. This purchase caused a great deal of excitement, and it was the general verdict throughout North America that the government of the United States had done a very foolish thing. It seemed sheer "wasteful extravagance to pay $7,000,000 for miles of icebergs and polar bears."

For a time the country was occupied by United States soldiers, but there was nothing for them to do, and a naval officer governed the country. He was withdrawn, and for years there was no government at all, except the tribal customs of the Eskimos and Indians, who were thinly scattered over the land. In 1884, Congress gave the president power to appoint a governor, but did not trouble to make laws for the country. The laws of Oregon were declared to be in force so far as they were suitable.

GOLD DRAWS MEN TO THE NEGLECTED TERRITORY

Though it was known that there was gold in Alaska, not much attention was paid to the fact, though in 1895 hundreds of men were engaged in mining, and one or two of the mines produced large quantities of the precious metal. In 1896, rich placer deposits were discovered in the Klondike, near the boundary, but on the Canadian side of the line. Placer mining means that free gold is scattered through the soil, and as the soil washes into the streams, much of it sinks to the bottom and remains in the sand. A man does not need any expensive machinery to get it out, but uses the pan, which has been described elsewhere.

Thousands rushed to the Klondike, and swarmed over on the American side, but did not find much gold until 1899. Then even richer deposits were found around Nome, on the western coast. Many other fields were discovered, and every boat that could float carried eager seekers for gold to the north. Some men were wonderfully successful. As the result of a single week's work a man might get thousands of dollars. Men went mad and fought for claims which showed good prospects, but some found no gold at all. Deep mines were opened, and more and more of the gold comes from them. Since 1910, about $16,000,000 a year has come from the country that was bought for less than half that sum.

Gold is found in almost every corner of Alaska, but the individual owners are losing their grasp, and the mountains and rivers are being worked by large corporations with ample capital to install expensive machinery. "The day of bucket and windlass has passed for the Klondike. Dredging and hydraulicking have taken their place, and the trains and steamers are loaded with powerful machinery to be operated by vast corporations."

MANY NATURAL RESOURCES BESIDES GOLD ARE PRESENT

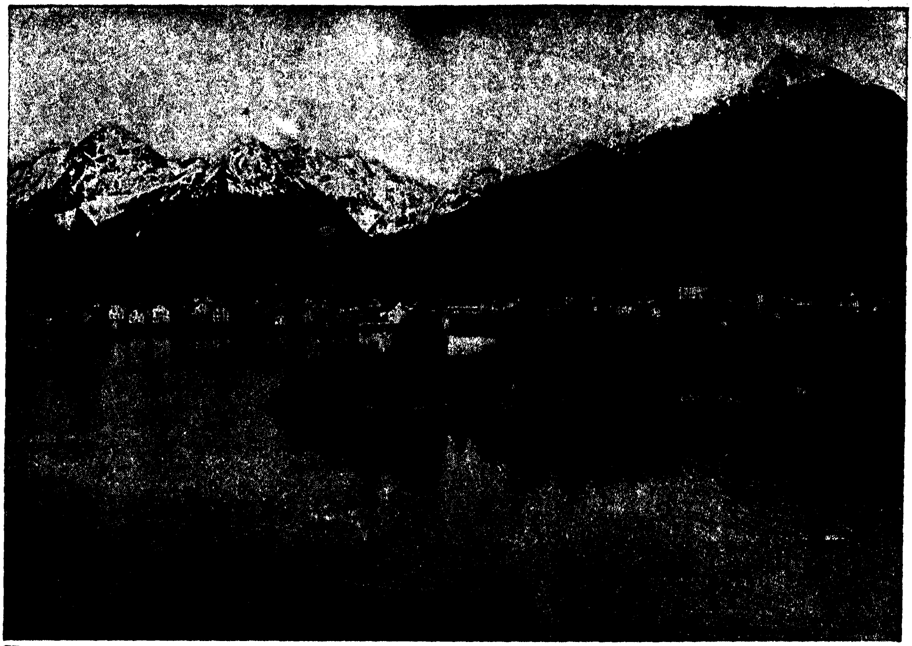
Gold is not the only mineral found in Alaska. Copper mining began in 1901, and since that time other deposits have been found, and now there are several smelters in operation. While not so large as the production of some of the states, the value of the copper produced is large and is increasing. Some day we may get much more than we do at present, as there seems to be almost an unlimited supply of the metal.

There are vast fields of coal in Alaska, but they have not been worked very much. Some of the coal is good, but much is rather low grade. Coal is so heavy in proportion to its value that the coal fields will not be worked until more railroads are built so that it can be moved more cheaply.

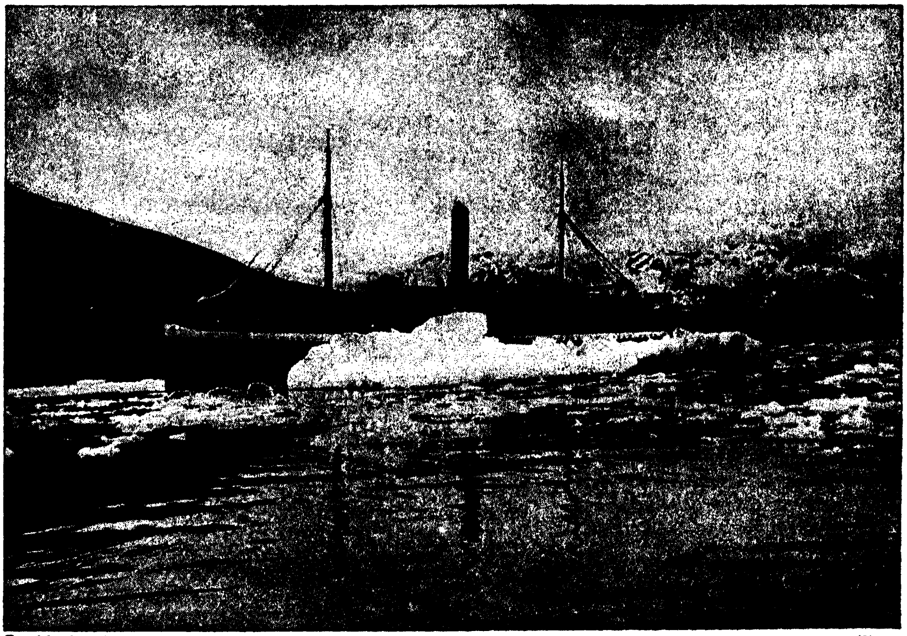
Tin is found, and there is some petroleum, though how much is not known. Some good marble is found, and some gypsum also. Small quantities of other minerals have been found. The truth is that the country has never been really explored, and we do not yet know how valuable the minerals are. Some men think that Alaska will, one day, be one of the chief mining districts of the world.

GARDENS AND FORESTS AT THE EDGES OF GLACIERS

Agriculture, too, has been found to be very profitable in the southeastern



Here is a picture of Sitka, the old capital of Alaska. Years ago it was the seat of the Russian governor, then it was the headquarters of the United States authorities. It is a sleepy, conservative old town, untouched by the bustle and activity that characterize the towns that have sprung up so quickly in the rush for gold. Though founded in 1799, the population in 1910 was only a little more than one thousand.



In Alaska the steamers must sail south before the long winter sets in or the chances are that they will be caught and held fast in the ice-locked waters of the northern seas. Here we see a tourist steamer making its way through the Takou Inlet to the Takou Glacier. It has been surrounded by floating cakes of ice and needs all the force of its powerful engines to push its way through the freezing waters.

portion of Alaska. Potatoes, cabbages, turnips, cauliflowers, beets, etc., grow to an enormous size in the short Alaskan summer. Like mushrooms they seem verily to spring up over night. It is one of the wonderful things of this northland that wild currants, blueberries, raspberries and luscious strawberries can be found growing in sheltered nooks under the very shadows of the glaciers, though some complain that they are too watery.

There are no large farms, for labor is very expensive, and many kinds of food can be brought from the United States more cheaply than they are raised, but the excellent market for fruits and vegetables makes market gardening very profitable. Some of the land produces excellent grass, and cattle and sheep are being raised. As the population increases, the amount of land cultivated will increase also. The United States has established experiment stations to find out what crops can be best grown.

There is much timber in Alaska. Hemlock, spruce and cedars are very common in some parts, and there are also poplar, aspen and birch. In some parts the trees do not grow large, but there are thousands of acres which can be used for paper-making. Some of the plains are treeless, but everywhere the wild flowers are many and beautiful.

FISH AND FURS ARE BOTH IMPORTANT

Many excellent food fish are found in Alaskan waters. The salmon is most important, and there are dozens of canneries which preserve the fish for export to all parts of the world. Several kinds are found in countless numbers, and some of them are smoked and dried instead of being placed in cans. Cod, halibut and herring are also caught. Though the whale is not a fish, we often speak of the whaling industry along with fishing. Men have hunted for whales around Alaska for a long time, but not so many are caught now as in former years.

Once the sea otter was common, but now it has almost disappeared. Thousands of seals once covered some of the islands, but they were hunted so vigorously that a few years ago they too seemed doomed. The United States Government took charge of them, however, and forbade any one to kill them. They have now increased in numbers, and it will not be long until sealskins will again be seen in the fur shops, as they were many years ago.

Sand otters, lynx, foxes, minks, bears, beavers, ermine and other fur-bearing animals are found, but the government allows them to be killed only at certain seasons of the year. Through these rules it is hoped that these animals will increase in numbers and that Alaska will continue to be able to furnish warm furs.

HOW THE REINDEER CAME TO ALASKA

The native inhabitants of Alaska are Eskimos and Indians. Most of them make their living by fishing and hunting. Sometimes game was scarce and they suffered from hunger. They had no domestic animals except dogs, which were used in hunting and to draw their sledges. Some wise men got the idea that the condition of the natives would be improved if they had a regular source of food, and, in 1892, the government began to bring in reindeer from Siberia. They were sold or loaned to the natives, who were taught to care for them. They have increased in numbers so rapidly that now they are sometimes killed for food. Many of the natives have herds of them and are growing prosperous. Their flesh is good for food, their skins for clothing, and they are trained to pull sledges.

RAILWAYS THE GREAT NEED OF THE COUNTRY

At the same time the population is very small. At the census of 1910 there were only about 37,000 white people, and 27,000 Indians and others in a territory almost one-fifth as large as the United States. It is plain that such a small population cannot build the railroads needed, but the population cannot grow large until the railroads are built. There are already several hundred miles, most of which has been built to connect mines with the seacoast, so that supplies and ore can be easily carried. The United States Government is building two longer lines which will do much to open the country. Some have dreamed of a road over the Aleutian Islands, which will connect by ferry with Siberia, so that one day we may go from New York to Paris by rail.

The government is building wagon roads, sled roads and trails in every direction. On some of them automobiles run, on others only sledges, drawn by dogs, or in a few cases by reindeer, can

go, while only foot-passengers can travel some of the trails. Men often use the rivers as highways in winter when the ice is thick. In summer, when the ice has gone out, boats go up and down.

THE CRAFTY HUSKIES, WHICH DRAW THE SLEDGES

But although the railroads have pushed their way into portions of Alaska, and there are several hundred miles of wagon roads, they do not reach one-fifth of the field as yet, and sled dogs and a few reindeer are largely used for transportation. A good dog in Alaska is worth anywhere from $50 up. The thick-furred, long-legged " Labrador huskies " are the most powerful as well as the most valuable. " A load of 150 pounds per dog is the usual burden, and seven to nine dogs are attached, each by a separate trace. The Labrador harness is used with them, so the dogs spread out fan-shaped from the sledge and do not interfere with each other. The 'malamutes,' or native Indian dogs, usually half-wolf, are driven and harnessed differently,—all in a line and one before the other. The malamute is the king of all thieves. He will pull the leather boots off your feet while you sleep and eat them for a midnight supper, and he delights to eat up his seal-hide harness. He has learned to open a wooden box and will devour canned food, opening any tin can made, with his sharp fangs, quicker than any steel can-opener. Once a day only they are fed on raw fish, and while the malamute prefers to pilfer, the husky will go and fish for himself when off duty. Seventy miles a day is the rule with the Indians and their dog teams, and the white man does almost as much."

During the height of the rush to the gold fields, such a sight as this was not uncommon. As soon as the spring opened, men made their way over the trails, carrying their packs on their backs. One man is carrying a canoe, which he will launch on a stream when he reaches it.

The dog-driver carries a club and seal-hide whip, both of which he uses un-

mercifully, for the dogs are very fierce and delight in fighting. A fight among these fierce, half-tamed dogs of the North is not like the fights we see among our own. They fight wolf fashion, strike and leap away, strike and leap away—and the fight is to the death. Each dog knows this law and fights with a horrible intentness. Leap and slash, they fight—until lips and heads and bodies are gashed and bleeding. Around the combatants sits a staring circle of huskies. When either dog shows signs of losing his feet they stand up eagerly; and when at last the defeated dog goes down, they close in snarling and yelping, and the dog, screaming with agony, disappears underneath a heaving mass of bodies. There is no mercy shown among the creatures of this wild land. The toil of the traces seems the supreme expression of their being. Men wise in the ways of the wild will tell you that sick dogs have been known to die of a broken heart when cut out of the traces.

Here you see men digging for gold on the surface; placer mining, it is called. The dirt they have dug will be washed and the gold will settle to the bottom of the pan. Some men made fortunes in a few weeks if they were lucky. Now more gold is obtained from the deep mines.

POPULATION IS THE CHIEF NEED OF ALASKA

Alaska is a wonderful country, and will be visited by more and more tourists as its marvels become better known. It has high mountains, great glaciers, deep forests, beautiful fields, wonderful flowers, and interesting animals. Some volcanoes are still alive.

In all the vast area of Alaska, there are too few people to subdue the land. If this is to be done, men must go with their families expecting to remain. When the last census was taken there were five white men for every white woman in the territory. The reason for this is the fact that many young men have gone to Alaska to seek their fortunes, expecting to return to their former homes. Many find after they have lived in this northern land for a time that they can never be satisfied anywhere else. Some day, when the railroads are built, the tide will turn toward this great territory so full of riches of many kinds. Many places in Europe which are quite as far north are inhabited by large populations. Norway, Sweden and Finland are in about the same latitude. There is no reason why Alaska cannot support hundreds of thousands of settlers. Perhaps we shall some day see the state of Alaska in the Union.

THE NEXT STORY OF THE UNITED STATES IS ON PAGE 4165.

BLOSSOMS

SEA SHELLS

These two beautiful pictures were painted by Albert Moore, the British artist whose decorative pictures are famous. "Blossoms" hangs in the National Gallery of British Art, and "Sea Shells" is reproduced here from a photograph by Caswall Smith.

A GREAT POEM BY ROBERT BURNS

ROBERT BURNS, the greatest of Scottish poets, did not write many poems of any length, most of his writings being in the shorter form of songs, in which class of poetry none has excelled him. One, and perhaps the most beautiful, of his few longer pieces is that here given. "The Cotter's Saturday Night" describes, with the purest admiration, a domestic picture of Scottish humble life which is probably as true to-day as it was in the time of Burns. The simple joys of the poor, the virtues of the lowly people, have ever been worthier of admiration than the gilded pleasures of the rich. In nothing that Burns wrote can we better observe the warm-hearted nature of the poet than in this poem in praise of these qualities, which not only make for the happiness of individuals, but for the power and patriotism of nations. The first verse of the poem is really an inscription to a certain Robert Aiken, who was one of the earliest friends of Burns, and whose memory is thus enshrined for ever.

THE COTTER'S SATURDAY NIGHT

CONTINUED FROM 3996

MY lov'd, my honour'd, much respected friend!
  No mercenary bard his homage pays;
With honest pride I scorn each selfish end,
  My dearest meed, a friend's esteem and praise.
To you I sing, in simple Scottish lays,
  The lowly train in life's sequester'd scene;
The native feelings strong, the guileless ways;
  What Aiken in a cottage would have been;
Ah! tho' his worth unknown, far happier there, I ween.

November chill blaws loud wi' angry sough;
  The short'ning winter day is near a close;
The miry beasts retreating frae the pleugh:
  The black'ning trains o' craws to their repose.
The toil-worn cotter frae his labour goes—
  This night his weekly moil is at an end—
Collects his spades, his mattocks, and his hoes,
  Hoping the morn in ease and rest to spend,
And weary, o'er the moor, his course does hameward bend.

At length his lonely cot appears in view,
  Beneath the shelter of an aged tree;
Th' expectant wee things, toddlin' stacher thro'
  To meet their dad, wi' flichterin' noise an' glee.
His wee bit ingle, blinkin' bonnily,
  His clean hearth-stane, his thriftie wifie's smile,
The lisping infant prattling on his knee,
  Does a' his weary carking cares beguile,
An' makes him quite forget his labour an' his toil.

Belyve the elder bairns come drapping in,
  At service out, amang the farmers roun';
Some ca' the pleugh, some herd, some tentie rin
  A cannie errand to a neebor town:
Their eldest hope, their Jenny, woman grown,
  In youthfu' bloom, love sparklin' in her e'e,
Comes hame, perhaps to show a bra' new gown,
  Or deposit her sair-won penny fee,
To help her parents dear, if they in hardship be.

Wi' joy unfeign'd brothers and sisters meet,
  An' each for other's welfare kindly spiers:
The social hours, swift-wing'd, unnotic'd fleet;
  Each tells the uncos that he sees or hears.
The parents, partial, e'e their hopefu' years,
  (Anticipation forward points the view):
The mother, wi' her needle an' her shears,
  Gars auld claes look amaist as weel's the new;
The father mixes a wi' admonition due.

Their master's an' their mistress's command
  The younkers a' are warned to obey,
An' mind their labours wi' an eydent hand,
  And ne'er, tho' out o' sight, to jauk or play:
"An' oh, be sure to fear the Lord alway,
  And mind your duty, duly, morn an' night!
Lest in temptation's path ye gang astray,
  Implore His counsel and assisting might!
They never sought in vain that sought the Lord aright!"

But, hark! a rap comes gently to the door.
  Jenny, wha kens the meaning o' the same,
Tells how a neebor lad cam o'er the moor,
  To do some errands, and convoy her hame.
The wily mother sees the conscious flame
  Sparkle in Jenny's e'e, and flush her cheek;
Wi' heart-struck anxious care inquires his name,
  While Jenny hafflins is afraid to speak:
Weel pleas'd the mother hears it's nae wild worthless rake.

Wi' kindly welcome Jenny brings him ben,
  A strappan youth; he taks the mother's eye:
Blithe Jenny sees the visit's no ill-ta'en;
  The father cracks o' horses, pleughs, and kye.
The youngster's artless heart o'erflows wi' joy,
  But, blate and laithfu', scarce can weel behave;
The mother, wi' a woman's wiles, can spy
  What makes the youth sae bashfu' an' sae grave,
Weel pleas'd to think her bairn's respected like the lave.

O happy love! where love like this is found!
O heart-felt raptures! bliss beyond compare!
I've paced much this weary mortal round,
And sage experience bids me this declare:
"If Heav'n a draught of heavenly pleasure spare,
One cordial in this melancholy vale,
'Tis when a youthful, loving, modest pair,
In other's arms breathe out the tender tale
Beneath the milk-white thorn that scents the ev'ning gale."

Is there, in human form that bears a heart,
A wretch, a villain, lost to love and truth,
That can, with studied, sly, ensnaring art,
Betray sweet Jenny's unsuspecting youth?
Curse on his perjur'd arts! dissembling smooth!
Are honou.. virtue, conscience, all exil'd?
Is there no pity, no relenting ruth,
Points to the parents fondling o'er their child;
Then paints the ruin'd maid, and their distraction wild?

But now the supper crowns their simple board:
The halesome parritch, chief o' Scotia's food;
The soupe their only hawkie does afford,
That 'yont the hallan snugly chows her cood;
The dame brings forth in complimental mood,
To grace the lad, her weel-hain'd kebbuck fell;
An' aft he's prest, an' aft he ca's it guid,
The frugal wifie, garrulous, will tell,
How 'twas a towmond auld, sin' 'lint was i' the bell.

The cheerfu' supper done, wi' serious face
They round the ingle form a circle wide:
The sire turns o'er, wi' patriarchal grace,
The big ha'-Bible, ance his father's pride:
His bonnet rev'rently is laid aside,
His lyart haffets wearing thin an' bare:
Those strains that once did sweet in Zion glide,
He wales a portion with judicious care;
And "Let us worship God!" he says, with solemn air.

They chant their artless notes in simple guise;
They tune their hearts—by far the noblest aim!
Perhaps Dundee's wild warbling measures rise,
Or plaintive Martyrs, worthy of the name;
Or noble Elgin beets the heav'nward flame,
The sweetest far of Scotia's holy lays:
Compar'd wi' these, Italian trills are tame;
The tickled ears no heart-felt raptures raise;
Nae unison hae they wi' our Creator's praise.

The priest-like father reads the sacred page,
How Abram was the friend of God on high;
Or Moses bade eternal warfare wage
With Amalek's ungracious progeny;
Or how the royal bard did groaning lie
Beneath the stroke of Heaven's avenging ire;
Or Job's pathetic plaint, and wailing cry;
Or rapt Isaiah's wild, seraphic fire;
Or other holy seers that tune the sacred lyre.

Perhaps the Christian volume is the theme:
How guiltless blood for guilty man was shed;
How He, who bore in Heaven the second name,
Had not on earth whereon to lay His head:
How His first followers and servants sped;
The precepts sage they wrote to many a land:
How he, who lone in Patmos banished,
Saw in the sun a mighty angel stand,
And heard great Bab'lon's doom pronounc'd by Heaven's command.

Then kneeling down to Heaven's Eternal King,
The saint, the father, and the husband prays:
Hope "springs exulting on triumphant wing,"
That thus they all shall meet in future days:
There ever bask in uncreated rays,
No more to sigh, or shed the bitter tear,
Together hymning their Creator's praise,
In such society yet still more dear;
While circling time moves round in an eternal sphere.

Compar'd with this, how poor Religion's pride,
In all the pomp of method, and of art,
When men display to congregations wide
Devotion's ev'ry grace, except the heart!
The Power, incens'd, the pageant will desert,
The pompous strain, the sacerdotal stole;
But haply, in some cottage far apart,
May hear, weel pleas'd, the language of the soul,
And in His Book of Life the inmates poor enrol.

Then homeward all take off their sev'ral way;
The youngling cottagers retire to rest;
The parent pair their secret homage pay,
And proffer up to Heav'n the warm request,
That He who stills the raven's clam'rous nest,
And decks the lily fair in flow'ry pride,
Would, in the way His wisdom sees the best,
For them and for their little ones provide;
But, chiefly, in their hearts with grace divine preside.

From scenes like these old Scotia's grandeur springs,
That makes her lov'd at home, rever'd abroad:
Princes and lords are but the breath of kings;
"An honest man's the noblest work of God!"
And, certes, in fair virtue's heav'nly road,
The cottage leaves the palace far behind.
What is a lordling's pomp?—a cumbrous load,
Disguising oft the wretch of human kind,
Studied in arts of hell, in wickedness refined!

O Scotia! my dear, my native soil!
For whom my warmest wish to Heaven is sent,
Long may thy hardy sons of rustic toil
Be blest with health, and peace, and sweet content!

And, oh, may Heav'n their simple lives
 prevent
 From luxury's contagion, weak and vile!
Then, howe'er crowns and coronets be rent,
 A virtuous populace may rise the while,
And stand, a wall of fire, around their much-
 lov'd Isle.

O Thou! who pour'd the patriotic tide
 That stream'd thro' Wallace's undaunted
 heart;
Who dar'd to nobly stem tyrannic pride,
 Or nobly die, the second glorious part
(The patriot's God, peculiarly Thou art,
 His friend, inspirer, guardian, and reward),
Oh, never, never, Scotia's realm desert,
 But still the patriot, and the patriot bard,
In bright succession raise, her ornament and
 guard!

SHAKESPEARE

Matthew Arnold, in this fine sonnet, conveys a splendid sense of Shakespeare's eminence over all the master-minds that have written in the English language. "Others abide our question" means that while other great poets or thinkers may be open to criticism or to question, Shakespeare speaks through his immortal verse with so divine a voice that we feel it is the very voice of truth itself and cannot be "questioned."

OTHERS abide our question. Thou art free.
 We ask and ask—Thou smilest and art still,
Out-topping knowledge. For the loftiest hill,
Who to the stars uncrowns his majesty,

Planting his steadfast footsteps in the sea,
Making the heaven of heavens his dwelling-
 place,
Spares but the cloudy border of his base
To the foiled searching of mortality;

And thou, who didst the stars and sunbeams
 know,
Self-schooled, self-scanned, self-honoured, self-
 secure,
Didst tread on earth unguessed at—Better so!

All pains the immortal spirits must endure,
All weakness which impairs, all griefs which
 bow,
Find their sole speech in that victorious brow.

TO A BUTTERFLY

The great poet William Wordsworth, in these pretty verses to a butterfly, gives us the proper point of view from which we ought to regard one of the loveliest of all created things. We can hardly read this poem, entering into the loving spirit of the poet, and then go chasing butterflies.

I'VE watch'd you now a full half-hour,
 Self-poised upon that yellow flower;
And, little Butterfly! indeed
I know not if you sleep or feed.
How motionless! not frozen seas
More motionless! and then
What joy awaits you, when the breeze
Has found you out among the trees,
And calls you forth again!

This plot of orchard-ground is ours;
My trees they are, my sister's flowers.
Here rest your wings when they are weary,
Here lodge as in a sanctuary!
Come often to us, fear no wrong;
Sit near us on the bough!
We'll talk of sunshine and of song,
And summer days when we were young;
Sweet childish days that were as long
As twenty days are now.

THY WAY, NOT MINE, O LORD

Dr. Horatius Bonar, who was born in Edinburgh, December 19, 1808, and died July 31, 1889, was a celebrated writer of hymns, which breathe the purest faith and hope. We have chosen the following example of his writings, as it is unrivaled for the expression of the Christian's faith, and ranks with Newman's beautiful hymn "Lead, Kindly Light," which is printed on page 2013.

THY way, not mine, O Lord,
 However dark it be;
Lead me by Thine own hand,
 Choose out the path for me.

Smooth let it be or rough,
 It will be still the best;
Winding or straight, it leads
 Right onward to Thy rest.

I dare not choose my lot;
 I would not if I might:
Choose Thou for me, my God,
 So shall I walk aright.

The kingdom that I seek
 Is Thine: so let the way
That leads to it be Thine,
 Else I must surely stray.

Take Thou my cup, and it
 With joy or sorrow fill,
As best to Thee may seem;
 Choose Thou my good and ill.

Choose Thou for me my friends,
 My sickness or my health;
Choose Thou my cares for me,
 My poverty or wealth.

THE CHARACTER OF A HAPPY LIFE

Sir Henry Wotton was a famous Englishman who lived from 1568 to 1639, and was eminent in the service of his country, being for many years its ambassador at Venice. In the later years of his life he became a clergyman, and wrote a number of essays, chiefly of a religious character. Like most of the scholars of his age, he also wrote poetry. He was a great friend of Izaak Walton, and often went fishing on the River Thames with him. Not more than fifteen of his poems are well known, and the following poem is the most familiar.

HOW happy is he born or taught,
 That serveth not another's will;
Whose armour is his honest thought,
 And simple truth his highest skill!

Whose passions not his masters are;
 Whose soul is still prepar'd for death;
Untied unto the world by care
 Of public fame, or vulgar breath!

Who envies none that chance doth raise,
 Or vice; who never understood
How deepest wounds are given by praise,
 Nor rules of state, but rules of good!

Who hath his life from rumours freed;
 Whose conscience is his strong retreat;
Whose state can neither flatterers feed,
 Nor ruin make oppressors great!

Who God doth late and early pray
 More of His grace than gifts to lend,
And entertains the harmless day
 With a well-chosen book or friend.

This man is freed from servile bands
 Of hope to rise or fear to fall:
Lord of himself, though not of lands,
 And having nothing, yet hath all.

THE SPACIOUS FIRMAMENT ON HIGH

On page 548 we gave Joseph Addison's paraphrase of the Twenty-third Psalm, and here we give the same author's paraphrase of the Nineteenth Psalm. In its Bible version this psalm was a great favorite of St. Augustine, and Addison has skilfully retained all the teaching of the original, while expressing it in the modern poetic form.

THE spacious firmament on high,
With all the blue ethereal sky,
And spangled heavens—a shining frame—
Their great Original proclaim.
The unwearied sun, from day to day,
Doth his Creator's power display,
And publishes to every land
The work of an Almighty hand.

Soon as the evening shades prevail,
The moon takes up the wondrous tale,
And, nightly, to the listening earth,
Repeats the story of her birth:
Whilst all the stars that round her burn,
And all the planets in their turn
Confirm the tidings as they roll,
And spread the truth from Pole to Pole.

What though in solemn silence all
Move round this dark terrestrial ball;
What though no real voice nor sound
Amidst their radiant orbs be found.
In reason's ear they all rejoice,
And utter forth a glorious voice,
For ever singing as they shine:
The hand that made us is Divine.

LULLABY! O LULLABY!

The writer of the following very popular baby song was William Cox Bennett, originally a watchmaker at Greenwich, where he was born in 1820. He afterwards became a journalist and wrote many songs and sketches, dying in 1895.

LULLABY! O lullaby!
Baby, hush that little cry!
Light is dying,
Bats are flying,
Bees to-day with work have done;
So, till comes the morrow's sun,
Let sleep kiss those bright eyes dry!
Lullaby! O lullaby!

Lullaby! O lullaby!
Hush'd are all things far and nigh;
Flowers are closing,
Birds reposing,
All sweet things with life are done.
Sweet, till dawns the morning sun,
Sleep then kiss those blue eyes dry,
Lullaby! O lullaby!

AMBITIOUS SOPHY

We have already printed two little poems by Mrs. Elizabeth Turner, whose simple verses pleased our grandmothers when they were young. She is the author of this poem.

MISS SOPHY, one fine sunny day,
Left her work and ran away;
When soon she reach'd the garden gate,
Which finding lock'd, she would not wait,
But tried to climb and scramble o'er
A gate as high as any door.

But little girls should never climb,
And Sophy won't another time;
For when, upon the highest rail,
Her frock was caught upon a nail,
She lost her hold, and, sad to tell,
Was hurt and bruised—for down she fell.

THE BABY AND THE BROOK

In this very beautiful song, sweet with the fresh charm of Nature, Longfellow, the American poet, has given an English setting to a short poem by the famous Armenian writer named Leon Alishan, which has been popular among the countrymen of that poet for many years.

DOWN from yon distant mountain height
The brooklet flows through the village street;
A boy comes forth to wash his hands,
Washing, yes, washing; there he stands,
In the water cool and sweet.

Brook, from what mountain dost thou come?
O my brooklet cool and sweet!
I come from yon mountain high and cold,
Where lieth the new snow on the old,
And melts in the summer heat.

Brook, to what river dost thou go?
O my brooklet, cool and sweet!
I go to the river there below
Where in bunches the violets grow,
And sun and shadow meet.

Brook, to what garden dost thou go?
O my brooklet, cool and sweet!
I go to the garden in the vale
Where all night long the nightingale
Her love-song doth repeat.

Brook, to what fountain dost thou go?
O my brooklet, cool and sweet!
I go to the fountain at whose brink
The maid that loves thee comes to drink,
And whenever she looks therein,
I rise to meet her, and kiss her chin,
And my joy is then complete.

BE PATIENT WITH THE CHILDREN

This little poem is anonymous, but the writer was evidently one who had a wonderful understanding of "Christ's little ones."

THEY are such tiny feet,
They have gone such a little way to meet
The years which are required to break
Their steps to evenness, and make
Them go
More sure and slow.

They are such little hands.
Be kind—things are so new, and life but stands
A step beyond the doorway. All around
New day has found
Such tempting things to shine upon; and so
The hands are tempted oft, you know.

They are such fond, clear eyes,
That widen to surprise
At every turn. They are so often held
To sun or showers—showers soon dispelled
By looking in our face.
Love asks, for such, much grace.

They are such frail, frail gifts,
Uncertain as the rifts
Of light that lie along the sky—
They may not be here by-and-by.
Give them not love, but more, above
And harder—patience with the love.

ASPIRATION.

**I know this earth is not my sphere,
For I cannot so narrow me but that
I still exceed it.**

LITTLE VERSES FOR VERY LITTLE PEOPLE

BOW, wow, wow, whose dog art thou?
Little Tom Tinker's dog.
Bow, wow, wow.

DICKERY, dickery, dare,
The pig flew up in the air;
The man in brown soon brought him down,
Dickery, dickery, dare.

"CROAK," said the toad, "I'm hungry, I think,
To-day I've had nothing to eat or to drink;
I'll crawl to a garden and jump through the pales,
And there I'll dine nicely on slugs and on snails."

"Ho, ho!" quoth the frog, "is that what you mean?
Then I'll hop away to the next meadow stream,
There I will drink, and eat worms and slugs, too,
And then I shall have a good dinner, like you."

PETER, Peter, pumpkin eater,
Had a wife and couldn't keep her;
He put her in a pumpkin shell,
And there he kept her very well.

MOLLY, my sister, and I fell out,
And what do you think it was about?
She loved coffee, and I loved tea,
And that was the reason we couldn't agree.

PUNCH and Judy
Fought for a pie,
Punch gave Judy
A knock in the eye.

Says Punch to Judy:
"Will you have any more?"
Says Judy to Punch:
"My eye is too sore."

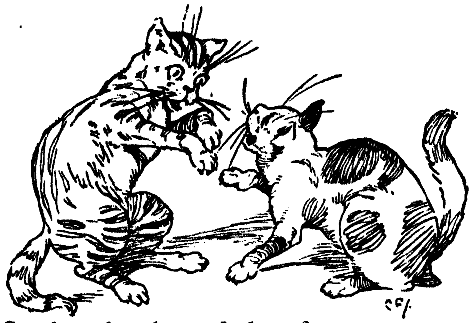
HUSH-A-BYE, baby,
Daddy is near;
Mamma is a lady,
And that's very clear.

THERE were three sisters in a hall;
There came a knight amongst them all.
Good-morrow, aunt, to the one;
Good-morrow, aunt, to the other;
Good-morrow, gentlewoman, to the third.
If you were my aunt,
As the other two be,
I would say good-morrow,
Then, aunts, all three.

CHARLEY, Charley, stole the barley
Out of the baker's shop,

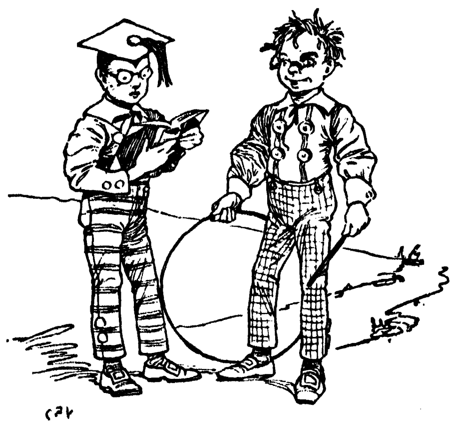
The baker came out and gave him a clout,
Which made poor Charley hop.

THERE were once two cats of Kilkenny,
Each thought there was one cat too many;



So they fought and they fit,
And they scratched and they bit,
Till, excepting their nails
And the tips of their tails,
Instead of two cats, there weren't any.

CLAP, clap handies,
Mammie's wee, wee ain;
Clap, clap handies,
Daddie's comin' hame;
Hame till his bonny wee bit laddie;
Clap, clap handies,
My wee, wee ain.



LITTLE Bobby Snooks was fond of his books,
And loved by his usher and master;
But naughty Jack Spry, he got a black eye,
And carries his nose in a plaster.

PUSSY-CAT MEW jumped over a coal,
And in her best petticoat burnt a great hole.
Poor Pussy's weeping, she'll have no more milk,
Until her best petticoat's mended with silk!

LAVENDER blue and rosemary green,
When I am king you shall be queen;
Call up my maids at four o'clock,
Some to the wheel and some to the rock,
Some to make hay and some to shear corn,
And you and I will keep ourselves warm.

A NICK and a nock,
A hen and a cock,
And a penny for my master.

AS I was going to sell my eggs,
I met a man with crooked legs;
Crooked legs and turned-up toes,
I tripped up his heels, and he fell on his nose.

ROBIN-A-BOBIN
Bent his bow,
Shot at a pigeon,
And killed a crow.

JACK SPRAT had a pig, who was not very little, nor yet very big;
He was not very lean, he was not very fat;
He'll do well for a grunt, says little Jack Sprat.

A TALE OF THE MIDDLE AGES

THE story of the life of Charles Reade, the novelist, is briefly told on page 2327. As there stated, Reade does not rank with the greatest story-writers in the English language, though he wrote many excellent novels and plays. But his best book, "The Cloister and the Hearth," is certainly a fine historical tale, even if it is not so great as the best of Sir Walter Scott's, or cannot be compared with Thackeray's "Henry Esmond." The story is partly founded on fact, but its real interest lies in the masterly way in which the author shows us the contending influences of "the cloister," which stands for the monkish life, and "the hearth," which stands for the life of the home circle and the love of our relatives and friends.

THE CLOISTER & THE HEARTH

CONTINUED FROM 3976

IT was past the middle of the fifteenth century, when Philip "the Good," by means not exactly honest, had been for many years ruling over Holland, that a well-to-do trader in cloth and curried leather, named Elias, together with his wife Catherine and their family, lived in the little town of Tergou, no great distance from the important city of Rotterdam.

The time had been when the nine children of Elias and Catherine had made merry music in the home, shedding brightness and happiness. But as they grew up, their various natures led them in different directions, and they brought sorrow and trouble where before they had made sunshine.

When our story opens, four of the family had left home, and were settled in various occupations, but five remained at Tergou. Giles, the dwarf, was a strange, passionate little creature with a shock of red hair, while Catherine was a poor little girl who could only move on crutches, but smiled through her pain and never spoke a fretful word. These two were unable to earn their bread, and the two others were unwilling. The unwilling ones were Sybrandt, the youngest, whose only desire was to pass his time in idleness or play, and Cornelis, the eldest, a mean, grudging fellow, who would not exert himself to advance his father's business, but was waiting for him to die, so that he might lay hands on his money. Time, however, played a game with him in which Cornelis was not the winner. If their parents had but small comfort in contemplating these four of their children, and thought of them always with misgivings, they usually concluded in a hopeful tone by saying: "But, thanks to St. Bavon and all the saints, there's Gerard."

For Gerard's future they had no fears, if they had no great hopes, as he was destined for the Church, having been carefully taught by the monks of a local convent. He was a skilled penman in an age when very few could write, and the ability to do so was considered a great accomplishment. But, more than this, there had settled at Tergou a certain Margaret van Eyck, sister of two famous brothers whose paintings are among the greatest treasures of European art to-day, and she taught Gerard the art of illuminating manuscripts in colors, at which he quickly became an adept. He was of a bright and happy nature, and if his thoughts were at all bent towards the life of a priest, that was less of his own free will than of his parents' wish.

Now, however unworthy the means by which Philip the Good had succeeded in imposing his rule upon Holland, the prince was at least a patron of the arts, and at Rotterdam he held a great exhibition, inviting all sorts of craftsmen and art-workers to compete for prizes which he

offered. So Gerard sent in specimens of his illuminating and writing on vellum. On the day when the prizes were to be distributed, dressed in his finest clothes, and carrying a letter to the young Princess Marie from his teacher, Margaret van Eyck, he set out with a light heart and high hope for Rotterdam. Of all the many journeyings of his life, this little journey was to prove the most eventful. On the way he fell in with an old man, accompanied by a beautiful daughter. They were evidently poor, and sat by the wayside exhausted. Gerard's kind heart was touched for them, and he shared his food with these weary wayfarers.

WHY THE BURGOMASTER OF TERGOU HAD AN UNEASY CONSCIENCE

It so happened that while he was sitting with them, there passed by, riding on a richly caparisoned mule, the Burgomaster, or Mayor, of Tergou. This person, Ghysbrecht van Swieten, was a notorious miser, and his withered old crab-apple face was a veritable symbol to the people of Tergou of all that was mean and niggardly. But to-day he was riding along in quite a self-satisfied manner, for he was to sup with the duke at Rotterdam.

As he came upon the little group by the wayside, however, the smile on his face changed suddenly to an expression of anger and uneasiness. He alone, with his guilty conscience, knew the reason of this. Some twenty years before, by an act of dishonesty, he had succeeded in enriching himself at the expense of this simple old man by the roadside, and when he saw Gerard, young, active, and educated, in the company of Peter Brandt and his daughter Margaret—for these were their names—his suspicious mind at once had thoughts that Gerard might have discovered his secret, and would help his victims to get back the property he had wrongfully withheld from them.

GERARD WINS A PRIZE AT ROTTERDAM, BUT LOSES HIS HEART

With these uneasy thoughts, the burgomaster continued on his way, while Gerard and his companions, all unconscious of Ghysbrecht's suspicions, made slower progress to Rotterdam. Here the hopes of the young man were fulfilled, as he found himself the winner of the prize for penmanship, and had a gold medal pinned on his breast and fifteen golden coins put in his purse. Not only this, but, thanks to the letter he carried, he had been warmly received by the Countess of Charlois and her daughter, the Princess Marie, and the countess promised he should have the gift of a church the very day after he had said his first Mass, for in those days the Roman Catholic Church was supreme. The Princess Marie would have had him a bishop at once, but her mother's promise was the easier to keep.

It would have been with the lightest of hearts and the briskest of steps that Gerard made his way back to Tergou, had he not, during his visit to the palace at Rotterdam, lost trace of Peter Brandt and Margaret. So charmed had he been with the old man's beautiful daughter, that the thought of not seeing her again made him sad. He had foolishly forgotten to ask their names or where they lived.

But it was not long after he had returned to his home that these were disclosed to him in a curious way. The burgomaster, keen to discover what Gerard knew about his relations with the Brandts, sent for him on pretence of requiring him to copy the town records. But the payment he offered would barely have bought pens, ink, and parchment, and Gerard protested that he required some reward for the time the writing would occupy.

THE WILY BURGOMASTER IS TOO CLEVER AND OUTWITS HIMSELF!

"Your time? Why, what is time to you at two-and-twenty? Say, rather, you are idle grown. You are in love. Your body is with these chanting monks, but your heart is with Peter Brandt and his red-haired girl."

"I know no Peter Brandt."

"Ye lie!" shouted Ghysbrecht. "Did I not find you at her elbow on the road to Rotterdam? And were you not seen at Peter's house at Sevenbergen the other day?"

Thus hoping to draw the young man to a confession, the burgomaster had only given him the information which Gerard most wished to have. Leaving Ghysbrecht's house, he set out forthwith to the neighboring town of Sevenbergen, bent on renewing his acquaintance with Margaret and Peter.

The burgomaster had sent a servant to spy upon Gérard, and when he heard whither the young man had gone, his

worst suspicions seemed to be confirmed. So now he set himself to work against him by informing Elias and Catherine of their son's movements, telling the father that unless he adopted strong measures he would never see his son a priest, as he was in love with Margaret.

Gerard was truly in love with Peter's daughter, and when charged with it by his father, he frankly acknowledged that it was his hope to make her his wife and never to become a priest. Elias then told him before them all that he had ordered the burgomaster to imprison him in the town gaol rather than let him marry Margaret. On hearing this, Gerard made a vow that he would never become a priest so long as Margaret lived.

In his trouble Gerard went to his gentle teacher, Margaret van Eyck, and she advized him to have but the courage to marry Peter's daughter and go away to Italy, where painters were honored as princes, and penmen were paid large sums of money for copying manuscripts. She even offered to find him the means of traveling. Gerard was determined, and though Margaret at first refused, she, too, was soon persuaded, and the banns of marriage were duly proclaimed.

At ten o'clock one morning, Gerard and Margaret took their places before the altar in the church of Sevenbergen, and the priest was just about to begin the religious ceremony, when the constables of Tergou came hurrying up the aisle and carried Gerard off a prisoner.

His father had kept his promise. Gerard now found himself lodged in the town gaol, where he was told by the burgomaster that he would remain a prisoner until he made an oath to leave Margaret Brandt and return to the Church to which he had, in a manner, belonged from his very cradle.

"Death sooner!" was Gerard's only answer to Ghysbrecht's threats.

The cell in which he found himself lodged was high up in a tower, and although the window was easily reached, it gave no hope of escape, as there was no possible means of descent, and a fall meant certain death. The apartment was bare of furniture, save for an old oaken chest, on which Gerard was seated, hungry and despairing, when, to his surprise, something struck the wall beyond him, and fell at his feet. It was an arrow, to which a skein of silken thread was fixed, and on which these words were written:

"Well beloved, make fast the silk to thy knife, and lower to us; hold thine end fast, then count an hundred, and draw up."

In a sudden access of renewed hope, Gerard pushed the great oak chest towards the window, and, hastily following out the instructions, pulled up the silken thread again, to find attached to it a line of thin cord, which, when he had hauled it in, brought up the end of a good stout rope. This he passed through the handles of the chest, tying it securely, but before venturing through the narrow window, he sought to make sure that the chest was sound, and, jumping on it with all his force, to his surprise, the side opened, and a great store of parchments fell out. Unwittingly he had touched some secret spring, but he did not pause to examine the contents. Satisfied with the strength of the chest, he now forced his way through a window, and, passing down the rope, was safely received below by Margaret Brandt and

GERARD ESCAPES FROM THE TOWER

As Gerard determined not to fulfil his parents' wishes by becoming a priest, but to marry his sweetheart, Margaret Brandt, his father had him imprisoned in the tower of the Tergou Town-hall, but Gerard escaped by means of a rope sent to him in a very strange way.

Martin Wittenhaagen, an old soldier who was a warm friend of the Brandts, and whose well-shot arrow had opened the gates of Gerard's prison.

As the trio were hastening away from the scene, they were amazed, on looking back, to see a strange figure with a head of fire ascending by the rope down which Gerard had come. For a moment Martin was filled with superstitious fears of the "haunted tower"—for it had that reputation—but another figure stood below, white and motionless. Margaret, with her woman's instinct, thought of Gerard's sister Kate, and, running to the figure, found it was she. Gerard, too, came forward, just as a strange, weird voice high up the tower was shouting: "Parchment, parchment, parchment!"

High up they saw the little figure of Giles, the dwarf, a lighted lantern hung at his neck, and his hands full of parchments, which he hurled down in bundles on their heads. When he had thus thrown out the contents of the chest, he slid down the rope himself, and, in his half-witted enthusiasm at the find he had made, offered to sell this unexpected stock to Gerard, for whom he had often found parchment.

GERARD'S ESCAPE FROM THE TOWER AND HIS PURSUIT IN THE FOREST

"Hush! You speak too loud," said Gerard. "Gather them up and follow us to a safer place." And, giving poor Giles a few coins, Gerard took the bundle, and made all speed to Sevenbergen with Margaret and Martin.

There was great commotion the next day, when it was found that the burgomaster's prisoner had escaped and that the parchments had disappeared. His servant set out in pursuit, but failed to find the runaway. So, the day after, Ghysbrecht, with his constables, rode over to Sevenbergen, only to find Peter's house deserted. From an upper window, however, the burgomaster caught a glimpse of Gerard and Margaret, accompanied by Martin, making to the forest, and immediately with his men he gave pursuit.

The burgomaster, on his mule, was the first to come up with them, but Gerard disabled him with a blow from his oaken staff, and presently the three had gained the forest, where Martin led them by puzzling paths into a thick pine-grove, where their pursuers were not likely to penetrate.

In the excitement of having beaten down his enemy, Gerard was inclined to be proud of his feat, but his gentle heart soon chided him, and he found himself hoping that he had not injured the old rascal very seriously. Another moment, however, and the fugitives had to think of themselves again. A deep baying sound coming through the woods proved that they were being pursued by bloodhounds.

PURSUED BY BLOODHOUNDS, BUT SAVED BY MARTIN'S BOW AND ARROW

Presently one of these fierce and ravening animals burst through the trees into the open wood, where Martin had led his companions. But the deadly arrow of the old soldier laid the bloodhound lifeless on the ground, and a second animal that followed on the heels of the first, stopping for a moment to sniff around its dead companion, also fell a victim to Martin's bow.

Saved from this terror, the three threaded their way through the forest, only to find the burgomaster, seated on his mule and with a rough bandage across the lower part of his face, which had suffered severely from Gerard's attack. He was keeping watch on the likeliest place for them to leave the forest, but in a few moments Gerard disposed of him, by knocking him off the mule, upon which Martin mounted with the half-fainting Margaret. With the active Gerard running beside, they soon outdistanced their pursuers and reached the German frontier. Here Gerard took a heartbroken farewell of his wife, and leaving her in charge of the good archer, who promised to see her safely back to Sevenbergen, he struck over the border and began his long and eventful journey to Rome.

WHAT HAPPENED AFTER GERARD'S FLIGHT FROM HOLLAND

He had no lack of adventures by the way, found strange companions, suffered many trials, worst of all, his parting from a bluff, hearty soldier named Denys, with whom he had become very friendly. But we will leave him on his way into Italy and follow the fortunes of Margaret meanwhile.

Martin Wittenhaagen had safely escorted her back to Sevenbergen, and then going straight to Rotterdam, laid the whole affair before the duke, and returned home with a free pardon for

himself and Gerard. But the excitement she had gone through resulted in Gerard's bride being taken with an illness, through which she was nursed by her good friend, Margaret van Eyck.

A friend of that lady, who had been a pupil of her famous brother Jan, and who was himself to become one of the greatest of the Flemish painters, Hans Memling by name, was now about to start for Italy, that wonderful land of painters and poets, and to him a letter was entrusted for Gerard. Hans, unhappily, gossipped in one of the taverns in Tergou about this letter, and one of those who heard him was Gerard's youngest brother, Sybrandt, who told Cornelis, and together they plotted how they might manage to keep their brother in Italy, and so share his inheritance.

They found in the burgomaster a willing accomplice, as that old miser had now good cause for hating Gerard. Ghysbrecht had discovered that the runaway had carried off a parchment relating to his transactions with Margaret's grandfather, which proved that the burgomaster had robbed her and her father of their property. Gerard had taken it away with him, saying that, as it was not a town record, he would read it at his leisure.

So Ghysbrecht, all too readily, joined with Cornelis and Sybrandt in their plot against Gerard, and wrote a letter, in which he imitated, as well as he could, the handwriting of Margaret van Eyck, saying in it that Gerard's young bride had died of a fever. This letter the brothers managed to substitute in the wallet of Hans Memling for the true one, and so began all the tragedy of the story.

Meanwhile, Gerard had taken ship from Venice, bound for Rome, had suffered shipwreck, and narrowly escaped with his life. Rome, however, he reached at last, and not without friends; for he had been the means of saving a woman and her child, whose home was in that city, and also a great, burly Dominican monk who was bound thither.

The name of the woman he had saved was Teresa; and her husband, Ludovico, out of gratitude to him, secured Gerard an interview with Brother Colonna, a famous friar of the Dominican order, to whom Gerard submitted examples of his beautiful penmanship in Greek and Latin, and his illuminating. Delighted with this work, the friar sounded his praise among all the learned people of Rome, and very soon the art of the young man from Holland was in such request that he was in a fair way of making his fortune by his clever pen. Among those who employed him was a certain Princess Clælia, who not only admired his art, but fell in love with him; and if Gerard could have forgotten Margaret he might have risen, by Clælia's help, to fame in Rome and lived in luxury. But the princess, being of a passionate nature, and accustomed to have people do as she wanted, when she found him cold towards her, threatened in her anger to have him assassinated. So he told her the sad story of how he left his native land, and how he had surrendered everything for Margaret's sake. The princess then advised him to quit Rome at once, saying: "Go! I will send you the means. If you cross my path again I shall kill you! Farewell! My heart is broken."

It was soon after this that, in a very gloomy frame of mind, Gerard one day

GERARD THRASHES THE BURGOMASTER

The Burgomaster of Tergou, with his constables, pursued Gerard, who had escaped to the forest with Margaret and Martin; but, coming alone upon the runaways, the burgomaster was speedily disabled by Gerard, and his mule was seized to help the fugitives in their escape.

found himself deciphering the contents of the parchment he had carried away with him from Tergou. To his amazement, he realized that it dealt with a loan of money granted by Ghysbrecht to Margaret's grandfather against the rents of certain land, but which loan must have been repaid many times over. The old miser had illegally kept the property, thus impoverishing Peter Brandt and Margaret.

HANS MEMLING'S VISIT TO ROME AND THE FATEFUL LETTER

"Fool," he cried aloud, "not to have read this before!" Fool, indeed, and tardily awake to his foolishness. But now he was all activity, and, taking horse, he rode to the nearest port whence he could engage a passage to Amsterdam, meaning to clear up his affairs in Rome and to return to Holland at once.

But when he came back from his errand, his landlady gave him a packet of silver crowns, together with a letter which Hans Memling, who had called in his absence, had left for him. Seizing the letter, he began eagerly to read it aloud, his voice changing presently to tones of terror, for it was the false story of the death of Margaret.

"It is a lie!" he cried, when he had read the bitter epistle to the end. "Where is this Hans? I will cram his murdering falsehood down his throat!" So saying, he fled from the house, and in the agony of his mind went furiously and aimlessly about the streets for hours before returning to his lodging.

GERARD'S DESPAIR AND HIS NARROW ESCAPE FROM DEATH

There he fell into a fever, which continued many days. And when he came to consciousness again, it was to find Brother Colonna, accompanied by Brother Jerome, the Dominican friar whom Gerard had helped at the time of the shipwreck, seated by his bed. They tried to console him, and spoke of the consolations which the Church had to offer to the wounded spirit and the bruised heart; but Gerard, in the deep dejection which had now come upon him, no longer doubting that the news was true, was in revolt against all suggestions of religion, and blindly furious at his unhappy fate.

When his strength had returned and he was about again, instead of turning his thoughts to the Church, he sought to forget his unhappiness by sharing in the gay life of Rome, which was then at its gayest under the Papal rule.

His companions now were fellows of bad repute; and once, when he was with a reckless company boating on the Tiber, he passed the Princess Clælia. She, recognizing him, was mortified to think that he should prefer such company to her own, and, her jealousy aroused once more, she hired an assassin to kill him. This assassin was none other than Teresa's husband, and when he found whom he had to kill he could not do the deed. Instead of killing Gerard he saved that unhappy man from drowning in the Tiber, and while he was on his way to his own house, carrying the dripping form of Gerard, he was hailed by Friar Jerome as he passed the monastery gates. That burly monk, recognizing Gerard's face, bade Ludovico carry him into the building. Thus, when Gerard awakened to consciousness again, the Dominican monk was by his side.

THE TRAGEDY OF THE LETTER MAKES A PRIEST OF GERARD AFTER ALL

And now he was no longer angry at the consolations of the Church, nor adverse to the thoughts of a monkish life. Indeed, he was soon persuaded that peace of mind and rest for his troubled spirit were to be found only in the fraternity of St. Dominic; and so, in due course, Gerard took the vows, and became a friar under the name of Brother Clement.

Our story now shifts back once more to those whom Gerard had left behind in Holland. There in Rotterdam there was another Gerard now, a little boy born to Margaret, named after the father who had never seen him. Denys, the jolly soldier, had gone away to Burgundy, and Margaret, working as a laundress, was struggling to support her aged father. Poor though they were, she might have been happy if she had but news of Gerard.

The birth of little Gerard had a curious effect in making Ghysbrecht, the burgomaster, strangely uneasy about the wrong he had done to Peter Brandt and his daughter. Parched and dry though his soul must have been, his conscience pricked him when he realized that he stood the robber of three generations, and that he had written the lying letter which was keeping Gerard in Italy under the

impression that Margaret was dead, and that nothing made it worth his while to return to Holland now. The slightest suspicious word from anyone made the old fellow tremble at the thought that his secret had been guessed, and his days were filled with gloomy forebodings. Yet old Peter was left to slip away unconscious of how his inheritance had been kept from him.

Our story changes once again, and now the scene is the famous River Rhine, down whose stream and along whose banks two missionaries were then journeying. On their way they preached in the churches, and eager audiences listened to them, for both were eloquent and seemed imbued with the spirit of the Gospel. Their purpose was, when they reached the city of Rotterdam, at the mouth of the Rhine, to take ship for England, there to continue the work they had just begun.

But on their way they parted company for a time, meaning to meet again at Rotterdam. Perhaps the fact that Brother Clement's sermons seemed to stir the people more deeply than Brother Jerome's had something to do with this parting of their ways, for even preachers can be jealous of each other's powers. At any rate, when Clement arrived at Rotterdam and inquired of the monks there about his old companion, they pointed out to him a ship which had just left port, and could be seen making full sail towards England.

"What, gone without me? Oh, Jerome, Jerome!" Clement exclaimed.

"Then you must be Brother Clement," said one of the monks, and he gave Clement a letter from Jerome, in which the writer told him that he might follow to England if he pleased, but that it would be better to stay behind and preach to his own countryfolk.

This was indeed a cruel cut to Brother Clement; but his heart was now in his work, and next Sunday he preached a splendid sermon in the church at Rotterdam. Here he learned news that shocked him, when he was told that Peter Brandt was dead and buried, and that Margaret still lived.

The person who told him had been a servant of the burgomaster. He did not recognize in Brother Clement Gerard of Tergou; and when he went on to tell the monk that he also knew of Ghysbrecht's perfidy in having supplied the false letter to Gerard's brothers, the monk started up wildly, and, rushing headlong down the street with clenched hands and blanched face, seemed like one gone mad.

THE DEATH OF MARGARET

The plague broke out in the town where Margaret's son was at school, and, hastening to take her boy away, she caught the disease. Gerard arrived only in time to perform his priestly duties at her deathbed.

As the other stood amazed at the strange result of the story he had told, his arm was grasped by a trembling hand, and Margaret stood beside him. When he told her in a few rambling sentences what had passed, she cried, in an excited voice:

"Oh, what have you done? See you not this is Gerard? Quick! Quick! Help me to Elias, for the power has all gone out of my body!"

At supper-time, when the family had assembled round the board at Gerard's old home, it was not Margaret who came in to take her vacant place, but a Dominican friar, livid with righteous rage. Stooping over the table in front of Cornelis and Sybrandt, he shrieked aloud the most terrible words of agonized reproach, to which the perfidious brothers listened in terror and dismay, and,

cowering and shuddering, almost hid themselves beneath the table, while Gerard tore a letter from his bosom and flung it down before his father

"Read that," he said sternly, "thou hard old man, that didst imprison thy son. Read and see what monsters thou hast brought into the world. The memory of my wrongs and hers will dwell with you all for ever. I will meet you again on the Judgment Day. On earth you will never see me more."

GERARD LEARNS THE TRUTH & MARGARET GETS HER FORTUNE TOO LATE

And in a moment, as he had come, so he was gone, leaving them stiff and cold and white as statues.

Rushing from the house, white and raging, Gerard passed Margaret on her way thither, but stayed not his frenzied haste; while within the house old Elias in his wrath would have killed his two evil sons had they not escaped.

The rest of the story is soon told, for all its tragedy is now before us, and nothing remains for its chief actors but resignation and devotion to a new ideal.

The burgomaster lay dying when Gerard went to see him at Tergou, intent on making him restore to Margaret her fortune, which he did, with added interest, for all the years he had wrongfully retained it. But when Margaret looked on her wealth with wondering eyes, her only words were: "Too late! Too late!" Nor did the inheritance of the property of Margaret van Eyck, who died soon after, help to dispel the cloud that had settled upon her life for ever. Gerard had disappeared again, as soon as he knew that Margaret was relieved of all worldly need, and she thought him hard of heart to show no wish to meet her or their child, forgetting, perhaps, the impassable barrier that lay between them.

HOW THE PRINCESS MARIE KEPT HER WORD TO GERARD

But when the Princess Marie heard that Gerard was now a priest, she fulfilled the old promise, and appointed him Vicar of Gouda. Meanwhile, however, the monk had been living as a hermit in a cave at Gouda, and took much persuading before he could be induced to go and live in Gouda Manse, where, no longer Brother Clement, friar and hermit, he stood forth as Gerard Eliassoen, Vicar of Gouda. Many serene and peaceful years were yet to be lived by Gerard and Margaret, who, though restored to each other, could never be united. He attended to his priestly duties, and she to the rearing of their son and the help of the poor.

As little Gerard grew up he was sent to one of the most famous schools, and great things were expected of him, so bright was his intelligence. But the plague broke out in the town where his school was, and Gerard hastened over to bring the boy away, only to find that Margaret had been there before him.

She had sent her son safely off to Rotterdam, but she herself had fallen ill with the plague, and Gerard was little more than in time to be with her, and comfort her in her last moments. He read the service at her grave with scarcely a tremor in his voice. But at the sound of the earth on her coffin he uttered a piercing shriek, and putting his hand to his breast said: "Ah, Jorian, something snapped within me! I felt it, and I heard it. Here!"

HOW GERARD'S LIFE WAS ENDED IN THE CLOISTER AT GOUDA

It was no more than a fortnight later that Gerard himself, broken in body as well as in heart, sought refuge in the Dominican convent near Gouda, and wished to be accepted there as a new brother who had come but to die.

The temporary prior of the convent was one named Brother Ambrose, who, on seeing Gerard, exclaimed, "Clement!" and Gerard said, "Jerome!" for it was his companion of many years ago.

When Gerard died, a few days later, under his linen was found a horse-hair shirt, and under that a long tress of auburn hair; and when the coffin was ready to be closed, Jerome cleared the cell, and put the tress of hair upon the dead man's bosom.

Elias and Catherine lived to a great age, so long, indeed, that both Gerard and Margaret grew to be dim memories to them. The yellow-haired laddie Gerard Gerardson belongs not to fiction, but to history. He lived to be the first scholar and divine of his epoch, and was also the heaven-born dramatist of his century; for under the name of Erasmus he became, and will be remembered for all time, as one of the world's great men.

THE NEXT FAMOUS BOOKS ARE ON PAGE 4137.

THE STORY OF THE BRITISH EMPIRE

WE have finished the history of England, yet the story is as wide as the world. The English live on a little island which seems hardly more than a speck on the map, yet from that little kingdom has grown an empire greater than any other empire that has been. One-fifth of the whole earth and one-fifth of its peoples live under the British flag. If we could walk over the earth, one out of every five persons we met would belong to the British empire. So vast is this Empire that the sun never sets upon it; it is an empire of eternal sun. We have read the story of all parts of the empire, but here, in these pages, we get an idea of what the British Empire itself means and how it has come to be. Great Britain has become a great nation because her sons have carried freedom beyond the seas, and it is a fine and solemn thing for them to remember that they are helping to make a nation whose influence reaches to every corner of the earth.

THE EMPIRE OF ETERNAL SUN

CONTINUED FROM 3933

THREE hundred years ago England and Scotland and Ireland were all ruled by a single king; they had been united for the first time under one monarch, James VI. of Scotland, who became James I. of England. But even then the nation did not own, outside of the British Isles, a single scrap of all the lands that are marked red on the map of the world to-day.

Yet that was 1,100 years after the Saxon Cerdic set up the kingdom of Wessex, and began the line of kings whose blood runs now in the veins of George V. In these three hundred years—quite a small space of time in the history of the British race—the whole of this great empire has been built up; and another great portion of the earth's surface—the history of which belongs to the same three hundred years—is also in possession of the same race, though it is not part of the empire, as it once was, and as it still might have been, perhaps, but for the blunders of statesmen one hundred and fifty years ago.

How was it that this great expansion, or spreading out, of the peoples of these small islands took place, so that regions so vast have fallen under their dominion in so short a time; that they have taken upon themselves the task of ruling millions upon millions of peoples with black skins and yellow skins, and of making the earth yield up her riches in lands where earlier inhabitants had been content to roam from place to place, plucking the fruits which grew ready to hand, or slaying wild creatures with bow and arrows?

Well, there had been no chance of expansion till just about a thousand years after Cerdic came to England. It was only then that Christopher Columbus found out that if ships sailed on and on westwards from Europe across the Atlantic they would come at last to land, which in those days men called the New World. And it was only then that the Portuguese sailors found out that if they sailed on and on southwards they could get round the end of Africa, and so sail on to the north-east till they came to India.

As Columbus was in the service of the King and Queen of Spain when he discovered America, the Spaniards claimed that it was a possession of theirs; while the Portuguese mariners made themselves lords of the Indian Ocean; and so those two nations got much store of merchandise and spices from the East, and of gold and silver from the mines in South America.

Now, at first the other European nations tried only to find whether other parts of America, to which the Spaniards had not gone, might not be richer than the islands of the West Indies or than the "Spanish Main"

itself, for this was the name by which the lands of which the Spaniards had taken possession were called. But presently the English began to think there was no reason why the Spaniards should be allowed to shut everyone else out of those lands, where it seemed almost as if there was nothing to do but pick up gold and silver, or make the natives do it for you; and so they began to fight the Spaniards.

HOW WALTER RALEIGH BEGAN BUILDING UP THE BRITISH EMPIRE

Then there arose, also, men with greater visions than those of just gathering up wealth at ease—men who dreamed of planting colonies, of creating a new England beyond the seas where wealth might be won, not without effort, but by energy and skill and endurance.

The first attempts which Sir Walter Raleigh made in the reign of Queen Elizabeth came to naught—because men were not content with the slow way of industry when the capture of a Spanish galleon might make a man rich for life at one blow. But in the reign of James I. the plans of Raleigh were at last carried out, when sundry merchants and others banded together to settle a number of Englishmen in a colony which they called Virginia.

Now, the peoples of North America, whom the English called Indians—because at first it had been supposed that it was India itself that Columbus had reached—lived for the most part in tribes, which roved from place to place; and they were fierce and merciless in their manner of warfare. And often grounds of quarrel would appear between the Englishmen and the redskins; so that many a time the settlers had to fight for their lives, and many times they gave the Indians reason to hate them, and to fear them, too.

THE MEETING OF ENGLISHMEN, FRENCHMEN, AND DUTCHMEN IN AMERICA

Nevertheless, the settlers prospered, and others came after them; and presently further northward there came new bands of colonists—Puritans, who were ready to leave their own homes in England in order that they might practise their religion after their own fashion, and not as they were ordered by the King of England. And then there came Dutchmen, who took possession between Virginia on the south and these "New England" colonies on the north. But soon afterwards, when there was a war between England and Holland, the Dutch gave up those colonies to England, and the English gave the name of New York to the principal town which had been Dutch. There came Frenchmen, too, who made colonies still further north, in what we call Canada, and further south in Louisiana.

Meanwhile, other merchants had banded themselves together to trade in the East with India and the islands which were called the Spice Islands; one company in London, and another in Holland. For the most part, it was the Dutch who sought trade in the Spice Islands, and the English who sought it in India. The English got leave from the Emperor of India, who was called the Mogul, to set up what was called a "factory," which meant offices and warehouses to store the goods which they bought from the Indians and the goods which they brought from England to sell. Later on when Charles II. married a Portuguese wife the Portuguese gave him Bombay, which had come into their possession long before.

HOW NORTH AMERICA WAS DIVIDED INTO BRITISH COLONIES

In this way the English got trading stations, or factories, at Bombay, and Madras, and Calcutta; and the French got trading stations not far from Madras and Calcutta.

So, a hundred and fifty years ago, the way of things was this. The English had for a long time given up troubling themselves about South America, which they left to the Spanish and Portuguese, as well as Mexico, the south-west corner of North America. But in North America, all along the coast from Florida in the south to Nova Scotia in the north, the country was divided up into British colonies or states, which had to obey any laws that were made for them by the Parliament of Great Britain, but were allowed in other ways to govern themselves. On the north and on the south were French colonies, but in the west the Indians still owned the land. The French and the British both thought they had a right to all that land, taking no count of the rights of the Indians; and since they would not share it, but each nation meant to have it, a time came

when the two countries went to war. At the end of the war the British had beaten the French so badly that France gave up Canada to England altogether, and all the French colonists in Canada became the subjects of King George III., and they or their descendants have been subjects of the British Crown ever since.

THE QUARREL IN WHICH AMERICA BROKE AWAY FROM THE MOTHERLAND

After that time numbers of Englishmen and Scots and Irishmen went out to Canada as colonists, as well as many people from the other American colonies. And so to this day many of the people of Canada are British and many of them are French, but all are loyal members of the British Empire. It so came to pass that, not long after Canada became British, the other colonies in America had such a quarrel with the Mother Country that there was a great war; and at the end of it, owing to the defeat of the British army, those colonies were separated altogether from the empire, and became the United States of America.

Now, while the French and the British were fighting out the question which of the two was to possess North America, they were also fighting out the question which of the two was to possess India—though neither of them at the time really guessed that India itself was going to be conquered.

For India was not at all like North America, where there were no civilized states, but only wild tribes. For India was made up of a number of great states containing many rich and great cities, and having vast armies with cannon like the Europeans, and strong fortresses. The rulers of those states owned the Mogul as emperor, though they paid little enough heed to his will.

FRENCH AND BRITISH GO TO INDIA ON BUSINESS, AND BEGIN FIGHTING

But as for the British and the French, they just had their few "factories" on the coast, with a little bit of ground, and a very few soldiers and guns in case they had to defend themselves from attack; and the rest of their people were the clerks and traders and managers, who were called governors, in the service of the British and French companies.

They had no wish to conquer the native states, and hardly anyone thought that it would be at all possible even if they did wish it. Only the French and British were each of them anxious to get all the best of the trading into their own hands, and to persuade the native rulers to give them advantages over the rival nation.

So when war broke out between England and France, the British and French in the south of India began to fight each other; and then, when some native princes began to fight each other for the thrones of their states, the French and British joined in on opposite sides. The end of it was that the British side won, and the French had to promise to keep no more soldiers in India at all.

But more than that: during the fighting the British themselves and the native princes learned that a few British soldiers, or native soldiers led by British officers, could defeat huge native armies. And when the prince who was called the Nawab of Bengal attacked the British in their factory at Calcutta, he was completely overthrown; and though a new Nawab was set up in his place, the Mogul very soon afterwards agreed that the British should govern Bengal; and that they could rule the country round Madras almost as if it belonged to them.

THE WAY IN WHICH THE BRITISH BEGAN TO RULE IN INDIA

Then, when the native princes saw that a new power had appeared in India, whenever they had quarrels among themselves one or another would ask the British to help them, or to protect them; while some of them thought that if they could only destroy the British they would be able to make themselves lords of their neighbours' lands. And whenever the British had to go to war, either to defend themselves or to protect an ally, the end of it was that some more lands came under the British rule.

So it happened that by degrees half of India passed into the hands of the British, while the various princes of the other half governed their own territories, but had to obey when the British thought fit to interfere. And at last, after the Moguls had disappeared altogether, the Queen of Great Britain and Ireland was proclaimed Empress of India, and all the princes owned her as their supreme ruler.

Now, here is a wonderful thing to think of: that although there are in India ten times as many natives as there are people in the British Islands, and a thousand times as many as the British

in India itself, yet they are ruled over by the British people. The British nation has taken upon itself the task of giving justice and order and good government to all those millions of people, whose ways are so utterly unlike their own that the wisest men who go to India, and spend their lives trying to do what is best for the people under their charge, come back at the last saying that they still know hardly anything about them. All that can be done is to strive to do justice among them ; for this at least we know, that their lot will be better, and their lives and property safer, while British rule is unshaken, than ever it was in the past, or would be if their rule were ended.

HOW THE BRITISH FLAG CAME TO WAVE OVER THE DUTCH IN AFRICA

But, besides India and Canada, our map shows us that the empire includes a larger part of Africa and all Australia, as well as New Zealand and a great number of smaller islands both in the Pacific Ocean and in the West Indies—that is, the islands near the central part of America, in the Atlantic.

Now, in South Africa, the Dutch were before the British ; but when the French Emperor Napoleon made Holland really subject to France, then the English, being at war with him, made the Dutch in South Africa submit to them. After the war was over, and Holland was freed from the French dominion, the King of Holland agreed that England should keep South Africa. Still, the Dutch there did not like English rule, and some of them founded two states farther inland.

Even quite a short time ago England had a war with those states, the end of which was that they, too, were brought under the British flag ; for before that war the English said that they were really subject to the Crown, though it had been agreed they should govern themselves, while they said that they were not subject to the Crown at all. But now everyone, British and Dutch alike, has just the same rights of sharing in the government, and all are free citizens of the empire, just as in Canada there is no difference between the people of French and of British descent.

THE MANY KINDS OF PEOPLE WHO LIVE UNDER THE BRITISH FLAG

In Africa, however, there are a great many more natives—who are either negroes, with black skins, or Hottentots, with brown skins—than there are white people. And these natives have to obey the laws which the white people make, though they are allowed to keep up their own customs unless they are dangerous or do harm in other ways.

Those native tribes which are warlike, and came centuries ago from other parts of Africa to conquer the quiet tribes, have to be watched very carefully. This makes the business of government all the more difficult, because people in England are always very anxious not to be harsh or unjust to the natives, and white people in Africa know that they must never let the natives imagine for a moment that they could conquer the whites. Opinions differ, and the people in England and the people out there do not always agree about what is best to be done.

The way in which the British Empire spread in Australia and New Zealand was not the same as in America, or India, or even Africa, for they have never had to fight about these lands.

A hundred years ago there were few Europeans in New Zealand, and fifty years before that there were not many more in Australia. The natives of New Zealand are a very vigorous people, called Maoris ; the colony was started by making a treaty with the Maoris, who agreed to obey English rule. Still, it was a long time before they and the British settlers became friendly ; that was brought about mainly because a great English governor, named Sir George Grey, insisted firmly on seeing fair play between them.

THE SPREADING OF THE BRITISH EMPIRE INTO AUSTRALIA

No one but the British thought of going to New Zealand. But when the British landed in Australia and hoisted the British flag, in 1788, over a hundred years ago, some French ships appeared. Perhaps, if they had reached the bay a week earlier, they might have hoisted the French flag first, and then Australia would have been French instead of British ! However, the countries were at peace then, so England's possession was not disputed by any one. The natives of Australia were not at all like the Maoris of New Zealand ; they were feeble savages when the British first went there.

Then the British found that this great land was one which was suited for breeding sheep and cattle. Later on rich gold-mines were found there; and more and more people went out and settled on the land and built cities, while the natives went into the great forests. There are no strong peoples among the Australian natives, but only little tribes which can never become dangerous except in the same way as bands of robbers. They do not make rule difficult, like the natives in Africa; still less is this land like India, where there are a thousand natives to every European. In that way Australia is more like Canada; more like a huge England without so many people.

Let us try to think what this mighty empire means—all the people who salute the British flag as their own. A million of people seems a great number, does it not? There are forty-five millions in the United Kingdom. But in a single one of the countries which it rules—India—there are over 300 millions. And there are more millions in Australia, and more in Canada, and more in Africa, and more scattered all over the world.

THE WONDERFUL LANGUAGES & PEOPLES THAT COME TOGETHER IN THE EMPIRE

There is hardly a language under the sun which is not the native tongue of a number of people who belong to the empire. You could bring together a hundred sons of the empire, not one of whom could understand a word that any of the others spoke. There is hardly a religion which does not include subjects of King George among its followers—Christians, Mohammedans, Buddhists, Hindus, sun and fire worshippers, and worshippers of strange and monstrous beings whom they have imagined for themselves as gods. There are black peoples who a little while ago were cannibals; long-haired South Sea Islanders and wooly-haired negroes; yellow skins and red skins; quite a number of different brown-skinned peoples in India alone, tall Sikhs and little Ghurkas, who love to fight shoulder to shoulder with the Highlanders; sturdy Bhils and fiery Pathans; Parsees, who come of the ancient people of Persia; Brahmins and Rajputs, descendants of the priests and warriors who conquered India five thousand years ago. And side by side with the British race in Canada are the descendants of Frenchmen bearing French names; and in South Africa, Dutchmen bearing Dutch names. They dwell in the frozen North; they dwell in the blazing tropics; amid ice and snow; under the palm and the deodar; in the lands of the moose and the walrus; in the lands of the elephant and the tiger; in lands where white children cannot grow up, and in kindlier climes where Britons can settle and make a home; in lands like the British Isles and lands as unlike the British Isles as they can be.

THE MIGHTY TRUST WHICH THEY HOLD FOR THE WORLD OF THE FUTURE

On page 854 of this book is a picture of little Walter Raleigh listening to a sailor telling wonderful stories of the things he had seen on the Spanish Main; and you could guess from the little boy's face how he was dreaming of the vast empire far over the seas which would grow and grow some day long after he was dead. It has grown up now; the British race has spread itself all over the world; it has not only made itself rich and powerful—which is a small thing after all—but it has made itself the guardian of the welfare of millions and millions of people who had less knowledge, or skill, or courage; it has taken upon its own shoulders what a poet has called the White Man's Burden. They must answer for it that they have striven for the welfare of these millions honestly, thoughtfully, unselfishly.

THE DREAM OF A LITTLE WALTER RALEIGH OF TO-DAY

If there were a little Walter Raleigh alive to-day, what would his dream be? Not of new lands to be won by stout hearts and strong hands, but of the duty which is far more glorious, and harder, too—of giving to all those peoples a rule merciful and just, peaceful and free. That is the duty in which the boys and girls of the British Empire of to-day will have to take their share when they grow up. That is what it means to be a citizen of the mightiest empire the world has ever seen—an empire which has done more than any other to teach the world the meaning of freedom, an empire that will no longer live, or deserve to live, if ever its citizens forget its own greatest lesson.

THE NEXT STORY OF COUNTRIES IS ON 4297

LITTLE PICTURE-STORIES IN FRENCH

First line: French. Second line: English words. Third line: As we say it in English.

Un matin une petite fille s'assit dans un jardin, jouant avec ses poupées.
One morning a little girl herself seated in a garden, playing with her dolls.
One morning a little girl sat in a garden, playing with her dolls.

Tout à coup une fée apparut. " Veux-tu aller dans le pays des fées ? "
All at (a) blow a fairy appeared. " Wishest thou to go into the country of the fairies ? "
Suddenly a fairy appeared. " Would you like to go to fairyland ? "

" Oui ! " La fée agita sa baguette, et elles s'envolèrent.
" Yes ! " The fairy agitated her wand, and they themselves flew away.
" Yes ! " The fairy waved her wand, and they flew away.

" Voici le pays des poupées ! " s'écria la petite fille. " Voilà ma poupée perdue ! "
" Here is the country of the dolls ! " herself cried the little girl. " There is my doll lost ! "
" This is doll-land," cried the little girl. " There is my lost dollie ! "

" Tu m'as abandonnée à la pluie, mais les fées m'ont soignée."
" Thou me hast abandoned to the rain, but the fairies me have cared for."
" You left me out in the rain, but the fairies took care of me."

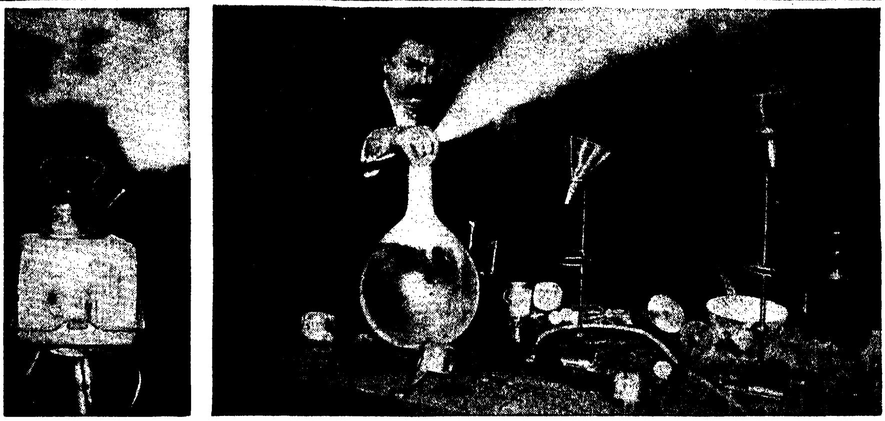
" Pauvre Bella ! Es-tu heureuse dans le pays des fées ? " " Mais oui."
" Poor Bella ! Art thou happy in the country of the fairies ? " " But yes."
" Poor Bella ! Are you happy in fairyland ? " " Yes."

" Que fais-tu toute la journée ? " " Nous jouons, nous chantons et nous dansons."
" What dost thou all the day ? " " We play, we sing and we dance."
" What do you do all day ? " " We play and we sing and we dance."

" Qui sont toutes ces autres poupées ? " " Des poupées qui ont perdu leurs merès."
" Who are all these other dolls ? " " Some dolls who have lost their mothers."
" Who are all these other dolls ? " " Dolls who have lost their mothers."

" Puis-je rester ici pour jouer avec toi ? " " Demande cela aux fées."
" May I to rest here for to play with thee ? " " Demand that to the fairies."
" May I stay here to play with you?" "Ask the fairies."

A ce moment une cloche sonna, et la petite fille se réveilla. C'était un rêve !
At that moment a bell sounded, and the little girl herself awoke. This was a dream !
Just then a bell rang, and the little girl awoke. It was a dream !



On the left, a kettle of liquid air standing on ice appears like a kettle of boiling water. The ice, being much warmer than the intensely cold air, changes it into gas like the atmosphere. In the second picture, liquid air is plunged into a bottle of water, and escapes with a loud, hissing sound like steam.

HOT THINGS AND COLD THINGS

CONTINUED FROM 3984

We know that matter may exist in a solid, liquid, or gaseous state, and we know, too, that, as a general rule, what we call heat makes a great difference in this respect. We take water and we make it cold, and if we go on making it cold long enough, it becomes solid. If we begin with this solid water, or ice, and add heat to it, it becomes liquid. We might say, then, that liquid water is ice plus heat—that is to say, ice with heat added. *Plus* means add. If now we add more heat to this liquid water, or, in short, if we boil it, it all disappears, and we know that it has gone into the air as water-vapor, or gaseous water.

So we can go farther and say that water-vapor is liquid water plus heat, just as liquid water is ice plus heat. If that sounds reasonable, we are already on the way to understanding what heat is, and as it is heat that we now have to study, we cannot do better than get this notion of heat as something added to matter, something that, as a rule, makes the difference between the different states of matter.

Now, the all-important question about which men have argued for ages is the question as to what this something is. We are fortunate enough, nowadays, to be able to come in at the end of the argument and get the result without the trouble of working it out. There is in heat a something that is undoubtedly real. We know there is nothing unreal about the heat of a red-hot poker. But is it a kind of matter? Is it a thing that could be weighed? Or, if not, what is it?

In the first place, it is possible to make certain that heat is not a thing which can be weighed. A hot thing, as we read upon page 3780, is no heavier than it was when it was cold. But every kind of matter has weight, because gravity acts on every kind of matter. Therefore, heat is not a kind of matter. But it is certainly something, and a very real something, and so we want to know what it is.

At one time men got out of the difficulty by inventing names. One of the greatest Englishmen of our time, George Meredith, said that "naming saves a lot of thinking"; and this is a case in point. Men said that they would call stones and water and gases, and so on, the things that could be weighed, or, to

use the long Latin word, the *ponderabilia*; then, they said, we will call the other things, such as heat, that cannot be weighed, but which are certainly very real, *imponderabilia*. But, of course, these long words really tell us nothing. We are not a bit farther on when we have invented them than we were before, though in all times and places, and on every kind of subject, men are apt to think that naming carries them along the road of progress.

In our own day we have learned what this thing really is that cannot be weighed. It is motion. Motion cannot be weighed; it cannot be handled or tasted, but it is very real, as we know. We know, too, that there are many kinds of motion, and, of course, it does not do to say that heat is motion unless we add that it is a very special and particular kind of motion, quite distinct from any other. We believe that heat is a special to-and-fro motion, which we have learned to call a vibration, of the atoms or molecules of which matter is made. Now, this idea, simple enough in itself, has very startling consequences.

THE SWINGING OF THE MOLECULES THAT MAKES WATER HOT

Let us consider a simple case like that of water. Let us imagine that we have a little liquid water before us; it may be cold or hot water, but, in any case, it has a certain amount of heat in it; in other words, its molecules are vibrating at a certain rate and, as we may suppose, with a certain length of swing to each vibration. Now, if we add heat to this water, we are adding to it—on our notion of what heat really is—more motion of this particular kind. Well, when the molecules of the water get this extra motion added to them—perhaps taking the form of a quicker motion, or perhaps taking the form of a longer swing, or perhaps both—the time comes when it is simply impossible for the molecules to swing so freely or so quickly, and yet to hold together in the way that makes liquid water. With so much heat in it, the water has to become gas, other things being equal, and it does so. It boils. This water-vapor, as it now is, may have still more heat added to it, nor can we say what limits there are in this direction.

But now let us travel in the other direction. Instead of adding heat, which is a special kind of motion, to the water, let us begin to take from it the heat that it already has. We know that, when we cool the water, in course of time it turns solid. Other things being equal—and we have to say this because the question of the pressure of the atmosphere really comes into this too—the molecules of the water can no longer be related in the way that makes the water liquid, if we take away from them too much of that particular kind of motion which we call heat. Deprived of much of this motion, the molecules have to arrange themselves in a different way, so that we have what we call ice.

ICE THAT CAN BE COOLED AND ICE THAT CAN BE HEATED

Now, though we all agree that liquid water may be hotter or colder, because we notice this every day, perhaps we are not all quite sure that ice may be hotter or colder; yet it certainly may. We can cool the ice as we cooled the water, and all the time we are taking away from it this particular kind of motion called heat; and so we may go on and up to a certain point.

Now, if a man has a certain amount of money, it may be added to, and there is no particular point at which no more can be added, and so it is with the addition of heat to anything. But if we start taking away a man's money, say, at the rate of one penny after another, the time is bound to come—and bound to come whether he started with a penny or with a million dollars—when he has no more money to lose, and, whatever we do to him, we cannot make him lose any more.

Now, what is true of money must be true of anything else, such as the kind of motion we call heat. As we cool the ice, we are taking this motion away from it, but the amount of it that the ice has is not infinite, and in course of time, if we go on steadily—though this may be tremendously difficult or impossible—we shall take away all the heat that was in the ice, and we shall have something which is absolutely cold.

HOW ICE CAN BE MADE SO COLD THAT IT CAN BECOME NO COLDER

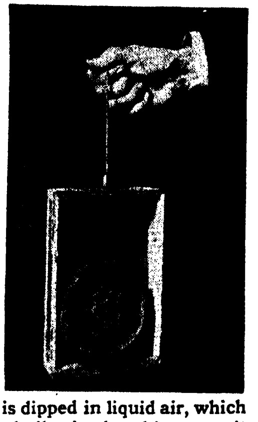
There is now no heat in the ice; the utmost part of the kind of motion we call heat has left it. So far as that kind of motion is concerned, its molecules and atoms are still; they cannot be colder. If heat is such as we suppose, this must be a possibility for matter of all kinds,

whether ice or anything else. Further, it is possible to find out how cold a thing would have to be so that it could be no colder, and we do indeed know what that point is compared with our ordinary scales of temperature, about which we have already learned something. In various ways it has been shown that 273 degrees below the zero on the centigrade scale is absolute cold. Matter reduced to that point would have no heat in it. Nothing can be colder than this. This discovery is one of the greatest that has ever been made in this part of science, and it has many interesting consequences, as we shall see.

First, let us consider the matter of measurement, always so important. We now have something better to go by even than the freezing-point and the boiling-point of water; we have something even better than the freezing-point of mercury or, indeed, of any substance that we know. We have discovered the existence of a point at which what we call heat has ceased to exist.

Plainly, that point must be nothing, or zero, on the best possible scale of temperature. So, while there is a zero on the centigrade scale, and on various other scales, we now have discovered the *real zero*, where heat and temperature really begin; and this we call the *absolute zero*. All over the world, men of science are rapidly learning to think and write in terms of this real scale of temperature.

Any student of heat, going to lectures or reading text-books, will find such phrases as "10 degrees absolute." The ordinary clumsy way of expressing that point on the scale would be "minus 263 degrees centigrade," and, of course, we can see at once what a great advantage it is to reckon on the new scale. It is a great find for science to have discovered Nature's zero of temperature instead of having to fix on some point far above that real zero, and then to call that point the zero because we know no better.



A leaden bullet tied to a string is dipped in liquid air, which makes it so cold that when the bullet is placed in water it freezes the water, and a tumbler can be suspended by the bullet, which freezes to the side of the glass, as in the first picture. On the right, a box containing a weight has a recess at the top filled with mercury. The cold bullet placed on the mercury freezes it, and the box is suspended like the glass.

The next question which must occur to everyone who thinks about this is: What is matter like at absolute zero? Let us imagine what this means. We have taken a gas, such as water-vapor or hydrogen, the molecules of which are moving about in a particular way, which we call heat. We have steadily taken away that motion; the gas has steadily become colder, first liquid and then solid. When we have taken away all the motion of this kind, what will be left? We must remember that the substance we are dealing with has steadily shrunk all the time; indeed, not merely part of its size, but by far the greater part of its size to begin with, was due to the heat in it. If now, as we cool it, its size begins to lessen, is it not quite possible that when we have made it absolutely cold there may be nothing left of it? This was at one time believed in, and we can see that it is not unreasonable. But now we believe that, even at absolute zero, matter would not disappear; in other words, heat is something added to matter, but heat is not matter. So, when all the heat has been taken away, there is still matter left, though it is not at all in the same state as with the heat added.

In the last paragraph it was said "we believe," and that has to be said because the correct answer to the next question, "Has matter ever been reduced to the absolute zero?" is No. So that we cannot yet say for certain. However, we have a great deal of evidence which makes us entitled to say that matter would not disappear at the absolute zero, even though we have never succeeded in reaching that point yet, and possibly

never shall reach it. In the first place, it is believed by astronomers that in the mighty tracts of space between the stars and planets there are quantities, by no means small, of matter, such as is often called *cosmic dust*. Now, students of heat are convinced that in these great spaces the temperature must be practically that of the absolute zero, the coldest possible cold. Therefore, the existence of this temperature does not mean that matter disappears.

In the second place, we have the evidence provided by our own little attempts on the earth to reach the absolute zero. Let us now see how far down the scale man has been able to go, and what results he obtains.

It is by no means a difficult thing to make carbon dioxide solid, and then it looks like a sort of very cold snow. After all, snow itself is only solid water-vapor, and the two cases are quite parallel. It is very much more difficult, but still it is possible, to take the mixture of gases which we call air, and first of all to make it liquid by cooling it very much, and then by cooling that liquid still more to make it become quite solid.

THE GREAT MARVEL OF LIQUID AIR THAT CAN BE POURED OUT LIKE WATER

Perhaps the greatest work of this kind has been done by Sir James Dewar, at the Royal Institution in London. Liquid air is vastly colder than ice, and it looks like water. It can be stored quite easily in vessels, and poured about just like water. A few drops running over our fingers would do them no harm, but, of course, we should not put our fingers in it, and the consequences of drinking it, which has been suggested, are too terrible to think about.

The use of liquid air is one of the most convenient ways for making low temperatures—that is to say, for making other things cold—and it is now very largely used in chemistry for this purpose. There has also been recently made a device whereby a rescuer going down into a coal-mine, in order to try to save the victims of an explosion, could carry liquid air down with him, and then, as it evaporated, he would have it to breathe. The suggestion has also been made, by the present writer, and doubtless by other students of the subject, that liquid air might be used, when it has become much cheaper than it is, as a means of ventilation. It would make rather a cold kind of ventilation, but probably nothing could be better if it were cheap enough. Of course, liquid air is always very much colder than anything around it, and this means that the kind of motion called heat pours into it from outside, and, as this happens, the liquid air evaporates, and turns into ordinary gaseous air again.

A PIECE OF SOLID AIR THAT CAN BE SEEN

No one could tell by looking at it that liquid air was not water, and when it is frozen no one could tell it from ice by looking at it. Solid air is, of course, very much colder than liquid air, but it is very far from having reached the lowest temperatures.

By the use of liquid air, and with the aid of very strong and expensive machinery, it is possible to liquefy all the gases that are known. It was a great triumph when the lightest of all the gases—hydrogen—was liquefied; and from liquid hydrogen there can be obtained for a few seconds solid hydrogen. Latterly, success has been obtained even with the gas helium, which had resisted all previous attempts; and this also has been liquefied.

Now, the question is: How low down in the scale do we get with such gases as these? The answer is that in the last few years steady progress has been made, and, instead of having to be content with, say, 14 degrees or 12 degrees absolute, we have got down to as low as 5, 4, and perhaps for a moment or so even just below 3 degrees absolute. Of course, when we say 3 degrees absolute, we mean 270 degrees below the freezing-point of water on the centigrade scale. Now, at first it sounds as if the great goal which all chemists desire will soon be attained: if we have got to within 2 or 3 degrees of the absolute zero, we can surely conquer the short distance that still remains; but of this we are not so certain.

THE TREMENDOUS DIFFICULTY OF GETTING ALL THE HEAT OUT OF A THING

In the first place, though 2 degrees or 3 degrees is not much in our ordinary way of thinking, yet that partly depends upon the way in which our minds are deceived by figures. If we chose a much finer reckoning, and divided every

degree into a thousand degrees, then the interval between solid helium or hydrogen and the absolute zero would sound much larger.

Then, again, it is the fact, and one which applies in many instances in science, that the farther we go the slower we go. We might suppose that to travel from 12 degrees absolute to 8 degrees would be just the same as to travel from 8 to 4 or from 4 to zero; but that is very far from being the case. Every degree lower is much harder to conquer than the one before.

Two illustrations will help us to understand this, though at first sight they seem absurd. There is first the excellent illustration, which we should all know, of the man who owed another man 32 cents and paid him first 16 cents, then 8 cents, then 4 cents, and so on, each time halving what he paid. Now, in a very short time the man to whom the 32 cents was owed got 31 cents; but not in the course of all eternity would he get the whole of the last cent, even though he got an instalment on these terms every second. Look at it from the point of view of the man who is trying to get the whole 32 cents, and we see that, as each time he is only getting half of what remains, however long he goes on there must always be left behind as much as he got last time.

Flowers placed in liquid air become frozen, and as brittle as glass, in a few moments.

Now, suppose that, instead of trying to get 32 cents out of a man, we are trying to get all the air out of an air-pump, and suppose that, just as the creditor got 16 cents when 32 cents was owing to him, and 8 cents when 16 cents was owing to him, so in this case every time we work the pump we withdraw half of the air remaining in the space we are trying to empty. We shall soon make it very empty indeed; but if we go on for ever on those terms we shall never empty it, because, however little remains before each stroke of the pump, we only get half of that out, and so it would go on always.

These illustrations help us to understand that it is more easy to conquer a hundred degrees downwards from the freezing-point of water than it is to conquer the last degree or two in the attempt to reach the coldest cold; and, indeed, it is probable that we shall never completely succeed. But a great deal has already been done, and it is extremely valuable indeed to go no lower than the temperature of liquid air, as the attainment of that has put into the hands of the modern chemist an instrument of the highest usefulness. One of the most interesting and important discoveries which we make when we study low temperatures is that the ordinary processes of chemistry are greatly changed. It seems, indeed, that by far the greater number of ordinary chemical processes, such as happen when a fire is burning, or such as those which are always going on in our own bodies, can only occur within a certain range of temperature. It is believed, for instance, that at the temperature of the sun things are too hot for any chemical processes to occur—that an atom of one kind cannot there combine with an atom of another, and, in consequence, there are only elements in the sun and no chemical compounds.

When we descend instead of ascending, the same result is, in general, true. Just as chemical processes cease at high temperatures, so most of them cease at very low temperatures. Elements which ordinarily combine with each other with great force, and perhaps explosive violence, do nothing at all with each other when put together at very low temperatures. Nevertheless, as Sir James Dewar and the great French chemist Moissan have shown, there is also a low-temperature chemistry about

which we know practically nothing as yet, because hitherto no one has been able to study it, and we did not know that such temperatures existed. This low-temperature chemistry has its own peculiarities and limitations, and when this new world of chemistry has been explored, it is certain to yield results of the greatest importance to knowledge generally.

THE GREAT HEAT THAT DESTROYS EVERY LIVING THING

It is of the greatest importance to study the relations of the extremes of temperature to life. Every living thing that we know has a certain range of temperature in which it lives best. Now, we may take a living thing, and we may study the effects of heat on the one hand, or cold on the other. The first general rule we discover is that heat is very fatal.

No living thing we know can survive the temperature of boiling water for any length of time. Certain microbes, if they happen to have covered themselves up with a thick coat for the time, may stand the temperature of boiling water for a minute or two, but that is all. Now, though boiling water is hot, its temperature is nothing at all compared with that of an ordinary flame, much less that of a furnace or the sun. We see, therefore, that the upward range of life in regard to temperature is very short indeed. Of the thousands of degrees upwards that can easily be attained, only a few tens have to be passed before life is destroyed.

The contrast when we go in the other direction is extraordinary. It has long been known that fish, microbes, and plants of various kinds will stand a great degree of exposure to ice without being killed.

MICROBES THAT STOP LIVING AND BEGIN TO LIVE AGAIN

But probably no one would have guessed the fact, which was proved at the Royal Institution a few years ago, that microbes which could not live for five minutes at the temperature of boiling water can be kept in liquid air for as long as six weeks on end, if not longer, and yet be found alive. This very remarkable discovery can now be explained almost with certainty. We are not to suppose that the microbes live at their ordinary rate and in their ordinary way while they are being subjected to this terrible cold. They seem, as it were, to stop living for the time, but they do not die. That upon which their life depends is not destroyed, and therefore when they are taken out of the liquid air they can start living again, so to speak; though while they were in it the cold was far too great to allow those chemical changes upon which life depends to go on.

We are learning that life depends upon *ferments* — very complicated chemical compounds which have the extraordinary power of starting and keeping up chemical processes in the things around them. Every known ferment is very easily destroyed by heat.

If we take a little pepsin, the stomach ferment, or any other, and boil it for a minute or two, it will never do any digestive work again. Here we see the reason why living things are so quickly destroyed by heat. They are killed because the ferments, without which they cannot live, are simply broken up by the heat, and when they are cooled down again there is no recovery, for these ferments are gone; and without ferments new ferments cannot be made. That is the great wonder of them.

WHY IT IS BAD FOR BOYS AND GIRLS TO EAT TOO MANY ICE CREAM SODAS

But take the case of the low temperature, and apply what we have already learned to it. The microbes that we take and bury in liquid air depend for their life—as do all living things—upon the ferments they contain. When heated, those same microbes would be killed because the ferments were destroyed. But cooling does not destroy a ferment; it merely stops the action of the ferment; digestion cannot go on in the cold. That is why it is bad for little boys and girls to eat too many ice cream sodas.

Therefore, as life depends upon the action of ferments, and as ferments cannot act in the cold, we cannot say that the microbes in liquid air are actually living, or, if they are living, they are, at any rate, "not doing anything at it." Yet, as we find afterwards, they are not killed, and the reason is that, though their living has been stopped for the time, the things upon which life depends have not been destroyed.

THE NEXT PART OF THIS IS ON PAGE 4229.

A WOMAN'S RIDE IN THE SEA

CONTINUED FROM 4027

BATTLING with the fierce winds and heaving waves in the effort to save life is hard work for strong men, and yet how many times have brave women risked their lives and faced the most appalling dangers in order to rescue men and women and children from a watery grave.

Some years ago a lady, named Miss Grace Bussell, who lived at Wallscliffe, in Western Australia, was reading in the drawing-room of her father's house, when a native servant rode up to the front door to say that a ship had been wrecked about seven miles down the coast, and was fast going to pieces on the rocks. A hurricane was blowing at the time, and the sea was lashed into a fury by the fierceness of the wind.

Without a moment's hesitation Miss Bussell ran to the stable, and, jumping on her father's horse, a fine animal, galloped off down the coast with the servant. The ship was about two hundred feet from the shore, and the waves were dashing over it in such a way that it was clear the vessel could not hold together very long.

The crew attempted to land some of the passengers in the ship's boat, but the boat had scarcely left the wreck when a large wave caught the little craft as though it were a cork and turned it right over, so that all the occupants were quickly hurled into the sea.

It was at this moment that Miss Bussell arrived at the spot directly opposite the wreck, and she immediately dashed into the angry sea and guided her brave steed towards the place where the people were struggling in the water. The servant followed her on his horse, and together they managed to bring a large number of the half-drowned people in safety to the shore.

Again and again Miss Bussell went out to battle with the storm and waves, and it was only with the greatest difficulty that she could keep her seat upon the horse's back. But each time she managed to reach the struggling victims of the wreck, and, swimming hither and thither among them, enabled some half-dozen or so to cling to the saddle or horse's mane and tail, and so assisted them to the shore.

The risk was very great, and on each occasion that Miss Bussell turned her horse's head towards the wreck, after bringing a party to land, it seemed that she could never succeed in her purpose. Still more impossible did it seem that she could ever reach the shore again with her living load. But her pluck and determination and skill, and the strength and endurance of her fine

animal, enabled her to perform the apparently impossible; and by dint of these repeated exertions the passengers and crew were, in due time, saved, including the men and women and the little children who had been on board. The last man was saved by the servant, Samuel Isaacs, who swam his horse out and rescued him just as he was about to sink.

Once, when Miss Bussell was bringing five or six exhausted people to shore, her horse's legs became entangled in a rope, and it looked as though nothing could save the party; but by clever handling Miss Bussell saved the animal from being washed over on to his side, and he was able to get his legs free of the rope. The medal of the Royal Humane Society was presented to the gallant lady for the bravery and courage she displayed on this occasion. Had it not been for her prompt and plucky action there would have been little hope for the passengers and crew, for on this part of the Australian coast there was not, at that time, any proper life-saving apparatus provided.

A BRAVE BOY'S REMARKABLE SWIM

FEW names are more honored in the annals of the British Navy than that of Sir Cloudesley Shovel, whose remains lie buried in Westminster Abbey. This brave but ill-fated admiral lost his life on a foggy October night in 1707, off the Scilly Islands, when his ship struck upon a rock, and went down with 800 men on board.

When a boy, young Shovel, whose parents were very poor, was apprenticed to a shoemaker; but he disliked the trade, and, having a longing to go to sea, he ran away, and was engaged as cabin-boy on a warship. Those were times of stress in the British Navy. England was at war with France, and it was not long before the boy saw active service.

He determined to make himself thoroughly proficient at his duties, and although as cabin-boy he had plenty of work to do, he still found time to study the principles of navigation. He was very brave, and his pleasing disposition endeared him to both the officers and men of the boat on which he sailed, for he was always ready to do anything for anyone, whether it were part of his regular duties or not.

During an engagement, young Cloudesley Shovel was on board a vessel upon which was the British commander, Sir John Narborough, and Sir John expressed an earnest desire that means might be found of conveying some important orders to another ship that lay a considerable distance away.

None of the older officers or men could offer any suggestion; but the boy, having overheard his commander's wish, approached Sir John Narborough, and begged that he might be allowed to carry the despatch. The officer looked at the boy in surprise, for it was hardly likely that a boy would have any useful or possible plan where able and experienced seamen failed.

"And how do you expect to get to the ship?" he asked.

"By swimming, sir," was the prompt reply.

"But the enemy are firing heavily all round, and it will be a very dangerous task."

"If I may be allowed to go, sir, I will undertake to carry the despatch safely to the ship."

Sir John Narborough was pleased at the confidence and bravery and energy shown by the boy, and, giving him the important document, he bade him make the attempt.

Cloudesley Shovel divested himself of nearly all his clothes, then, taking the despatch in his mouth, he jumped into the water, and struck out for the other ship. The path lay across the enemy's line of fire, and the shots were striking the water all around. But, by what seemed a miracle, he escaped, and, swimming hard all the time, he at last reached his destination, and was able to deliver the despatch safe and sound.

It was indeed a remarkable feat for a boy, and Shovel soon rose to be an officer, and eventually an admiral and a knight. In addition to many exploits in regular warfare, he did much good in suppressing piracy in the Mediterranean Sea, at a time when the people of the Barbary States lived largely by preying upon the commerce of other nations.

In 1674, as a lieutenant under Sir John Narborough, he punished the pirates very severely at Tripoli, burning four of their ships under the very walls and castles of their stronghold.

A BOY'S LOVE FOR HIS MOTHER

JEAN VIGIER'S mother was a widow with four sons, whom she found it difficult to bring up and to educate, for she was very poor. Kind friends found situations for the three elder sons, but the youngest, Jean, a clever, promising boy of nine and a half, they wished to keep at school. Yet they could not afford to do that and help the weakly mother at the same time; so it was decided that she must go to the poor-house, while Jean stayed at boarding-school. Then the curé invited the boy to his house to tell him of this decision.

Now, Jean was rather inquisitive, and, when left alone for a few minutes, he looked at a paper on the curé's table, and he found that this paper was an order for his mother's admission to the poor-house. Alarmed, the boy ran out of the house and back to school, where he put on his working suit. Then returning to the curé, he said: "I know it all; but mother shall *not* go to the poor-house. I am going to stay with her and support her."

The curé tried to reason with the boy, and pointed out that in the end it would be better for his mother if he were well educated, for then he could earn more money than if he remained ignorant. But Jean was ambitious to help his mother, and when he found his brothers were unwilling to help him, he sold his clothes and a watch he had received as a reward at school, and, with the proceeds, bought cakes and toys, which he hawked about the streets of Aurillac.

People liked to buy of the bright little fellow, especially when they knew how he loved and cared for his mother; and he prospered so that he was soon able to earn enough to support himself and her.

THE LOVE THAT IS STRONGER THAN DEATH

IN the turbulent times that followed the death of Julius Cæsar, Cicero and his brother Quintus were both placed upon the secret list of those who should be put to death. Learning of their danger, they fled from Rome, and had gone some distance towards the coast, when they suddenly remembered that they had very little money with them.

Quintus thereupon undertook to return to the city for the necessary means, while Cicero proceeded on his flight. Arrived at Rome, Quintus made his way to his house, but his return was soon known, and soldiers were sent to kill him. He managed to conceal himself so well that, although the assassins searched the house, they could not find him.

This enraged them so much that they seized the son of Quintus, and put him to the torture to make him disclose his father's whereabouts. But although the pain was terrible, and the cruel torturers spared no means that their wicked ingenuity could think of, the brave young Roman remained firm, and absolutely refused to say where his father was hidden.

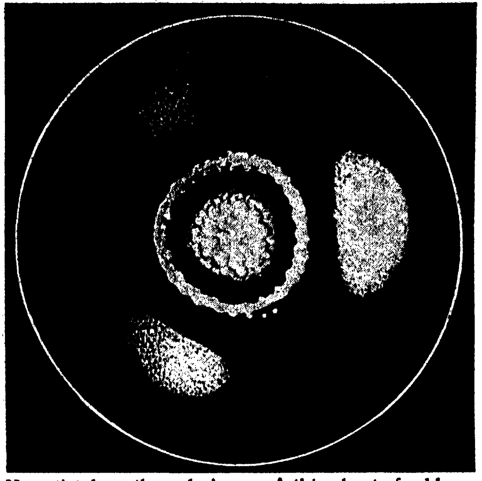
Again and again they applied the torture, and at last from time to time a groan escaped the suffering youth, which reached his father's ears. Quintus endured the agony of hearing his son's sufferings on his behalf for a little while, and then, running from his hiding-place, he surrendered to the soldiers, and begged them, with tears in his eyes, to kill him, but to spare the innocent youth who had done no harm to them or to their master.

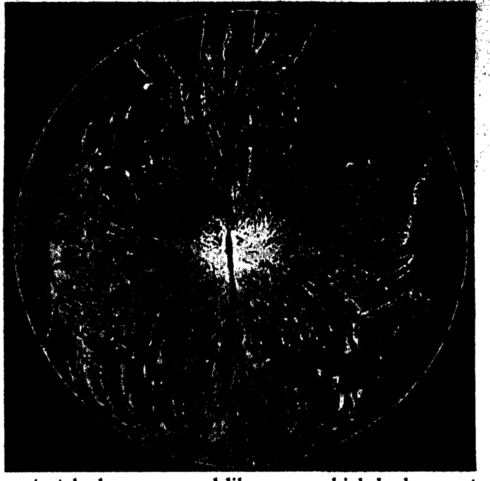
But such a thing as pity was unknown to these base murderers, hired to do the wicked work of men as evil as themselves, and they only mocked at the father's prayers and the son's pain. They must both die, they declared: the father because he had been condemned, and the son because he had tried to conceal his father.

The unhappy pair accepted their fate with gallant resignation, but they now disputed as to who should suffer first, each desiring to be the first victim, so that the other might be spared a few moments more of life. The cruel assassins, however, settled the matter, and saved them both from the agony of surviving the other, even for a moment. The murderers divided themselves into two groups, and beheaded father and son at the same moment. Few more pathetic and inspiring instances of the mutual devotion of father and son are to be found in all history.

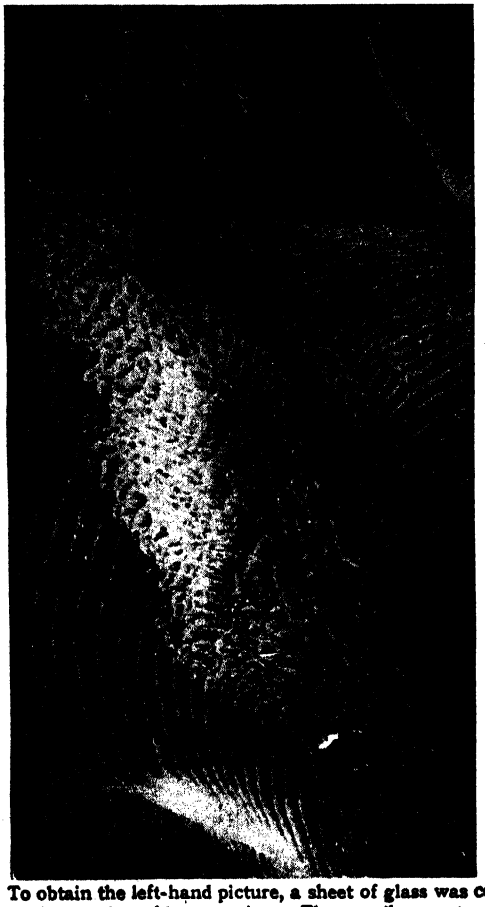
THE NEXT GOLDEN DEEDS ARE ON PAGE 4191.

PICTURES DRAWN BY THE HUMAN VOICE

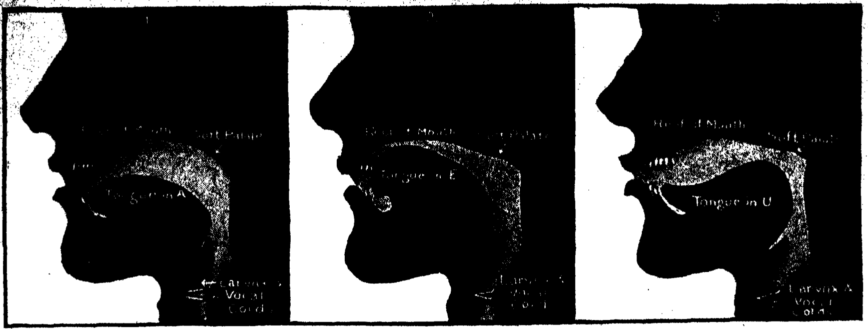




No artist drew these designs. A thin sheet of rubber was stretched over a vessel like a cup which had a spout at the side. Some light powder was thrown upon the rubber covering, and when someone sang into the spout, the powder formed itself into the design of the picture on the left. The right-hand picture, which looks like a frosted window, was drawn in the same way, but moist paint was used instead of powder.



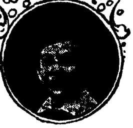
To obtain the left-hand picture, a sheet of glass was coated with paint and put over the cup, with the paint resting on the rubber covering. Then, as the spout was sung into, the glass was moved round, and this design appeared. The picture on the right—something like a fern-leaf—was made by singing louder and using moister paint. The cup with a spout or tube is called an eidophone, which means "form of the voice."



Here we see the positions taken by the tongue and lips when different vowels are pronounced. The position of the larynx remains the same, the different sounds being produced by the changed position of the resonators, or cavities above the larynx. The vowels shown are A, as in father, E, and U.

TALKING AND SINGING

CONTINUED FROM 4002



WE know how the larynx, or voice-box, the musical instrument which we all possess, produces notes of any particular pitch that we desire. But though singing is very delightful and precious, and though many books might be written upon the voice-box and its use in singing, speaking is really much more important than singing, and therefore it is necessary to study speaking from the point of view of the machinery by which it is done.

We have already learned about the wonderful centre in the brain where words and the meaning of them are stored, and we understand that everything else depends upon the orders given there, but now we must go on to study the machinery by which those orders are carried out. The voice-box is, of course, the central part of this machinery, but it is not all; and, indeed, everyone knows, who has whispered, that it is possible to speak without the voice-box at all.

There is one point which has been greatly discussed by many thinkers, and which we must mention first. We know that we ourselves both speak and sing, and when we observe the birds, we find that they sing, but do not speak. The question is: Did singing or speaking come first? And there is a difference of opinion on this matter. A great Frenchman, named Diderot, at the end of the eighteenth century, and Herbert Spencer, many years after, supposed that singing came later than speaking. Their argument was that, after learning merely to speak, the time came when men wanted to make their speech more effective and thrilling and moving, and so they sang the words instead of only speaking them. So on this theory speech came first, and song is a sort of speech with more effect added to it by the addition of music.

But against these great opinions there is another great opinion—that of Charles Darwin. For many years he studied the expressions of feeling in man and in the lower animals. He found, as he thought, that many of the lower animals, especially the birds, sing of set purpose, so to speak, and perhaps sing very beautifully. He supposed that the special reason for the song of animals was to call each other and to please each other. Now, on this view, song came first with the animals, and speech afterwards with man, and that is what Darwin maintained.

This is a subject which the writer of this story has specially tried to study, and what he thinks is that in

the case of mankind speech and song have arisen together. They are really two varieties of the same thing, which is expression by means of the voice. The argument of Diderot and Spencer that speech came first and song afterwards is not supported by the fact that, when we observe the growth of very small children, we can see the beginnings of speech and of singing growing up at one and the same time in them; nor is there any reason at all why this should not be the case. However this may be—and it is at least an interesting subject to think about—let us now go on to study what happens when we speak.

WHY IT IS THAT WE USE DIFFERENT NOTES IN SPEAKING

First of all, let us discover what is the difference between singing and speaking. In both cases we produce sounds by means of the voice-box, except in whispering; in both cases these sounds are musical notes—that is to say, the waves which form them are regular; in both cases there are changes of pitch.

No one speaks with his voice all the time on the same note, even in the shortest sentence. We raise the voice sometimes, we lower it at other times, as we go along, and we convey a great deal by the way in which we do this; so much so, that children or foreigners, who do not understand the words we are saying, may learn a great deal from the pitch of the notes we use.

Even a dog or a horse will learn much from our voices in the same way. If anyone doubts that we use a number of different notes when we speak, let him get someone to say a sentence all on the same note, without raising his voice or lowering it. The Greek word for one is *monos*, and so, when something is spoken or sung all on the same note, we say that it is a monotone, and thus we get the word monotonous.

HOW WE ARE ABLE TO PUT COLOR INTO OUR VOICES

We could scarcely live with anyone who spoke in a really monotonous voice. Also, we use different loudnesses when we speak, and, apart from the actual note we are speaking on, we use different kinds of what is often called color in our voices. We speak to a child in a more tender tone than we speak to a bus conductor, though we may speak more loudly to the child than to him. There are many different shades of expression which we can put into the same words spoken on the same notes and with the same loudness.

Now, the reason why it has been necessary to go so carefully into this is that we want to find out the difference between speaking and singing, and the first thing we find is that in all real points the singer does no more than the speaker does. He uses a variety of notes, he uses a variety of force, he uses a variety of colors. It may be added also that both singers and speakers use a variety of rhythm and speed.

But, nevertheless, no one will say that speaking and singing are the same, and everyone knows what it is to hear someone speaking in a sing-song voice. There is a common English word which has a very interesting history that bears on this point. It is the word cant. We say that a thing is cant or that a person is canting when we mean that he is professing high ideas that he does not really believe. The word comes from the Latin *canto*, I sing. Cant and chant are really the same word, and we might as well say that a person is chanting as that he is canting.

WHAT HAPPENS WHEN ANYBODY SPEAKS IN A SING-SONG WAY

The explanation is that at a very interesting time in the history of England there were certain people, having very strict views on many things, who had the habit of speaking in a sing-song way. When they spoke they chanted. Their enemies said that they did not believe what they professed, and so the word cant, which really means singing, came to mean insincerity.

Now let us ask what it is that happens when a person, who was speaking in the ordinary way, speaks in a sing-song way, or actually sings. What happens is that he now produces notes which have fixed regular intervals between them, like the notes on a piano. When we speak we do not use the fixed musical intervals of pitch, but slide the voice up and down, without taking any notice of the fixed intervals of music at all. It is true, also, that as a rule, when we speak, we may keep our voice within the limits of, perhaps, half an octave or less, while when we sing we may range over a couple of octaves or more. But though this is evident directly we think about it,

it is not the real difference between speaking and singing, which is that in singing we use only notes with fixed intervals between them, while in speaking we let our voice rest just where we please. If we think of a violin, we can, perhaps, understand this better. A player gets definite notes on the violin, such as the notes that are on the piano, by placing his fingers firmly on the strings at fixed intervals.

One of the great problems for the player is to get his fingers always at exactly the right places on the string. Now, when we sing, it is as if we were using just those intervals, only that, as we have seen, we do not get our notes by the violin player's method, but by tightening or loosening our vocal cords. If we do not use these intervals when we sing, people say that we are singing out of tune, and go out of the room as quickly as possible, and we are only asked to sing by people who have never heard us sing before.

WHY DIFFERENT PEOPLE HAVE DIFFERENT KINDS OF VOICES

But the violinist can also move his bow across a string and make it sound, while, at the same time, instead of stopping the string at certain intervals, he slides a finger right along the string, So, as the string gets gradually longer or shorter, he produces a series of notes —thousands in number really—which cannot be imitated on the piano. Now, our vocal cords can have any tightness or slackness, and so it is possible for us to pitch our voices, as we speak, at any point we like, just as if the violinist were to stop moving his finger at *any* point along the string of his instrument.

One of the great differences between voices is in the person's choice of the notes on which he speaks. It might be supposed that if one did not sing, it would be all the same what notes one used; but we all know that there are people to whose speaking voice it is a real delight to listen. It may be noticed sometimes that well-trained singers, who sing quite well, but are not really musical, speak unmusically, and everyone knows cases of people who do not sing at all, but who have most beautiful speaking voices. To people with sensitive ears there is scarcely a greater delight in life than to be surrounded by people with beautiful speaking voices, and one of the reasons why we ought to study this question here is that we are running a grave risk to-day of losing the beauty of our speaking voices, and for several reasons.

THE GREAT CARE THAT SHOULD BE TAKEN OF THE VOICE IN LARGE FAMILIES

One reason is simply the way in which we crowd together. It is probably safe to say that more pleasant speaking voices come from small families than from large ones. If we are one of twelve children, and we want to be heard—well, we are rather apt to discover which is the most piercing tone we can produce, and then, perhaps, we use that all the rest of our life. People should take great care of their children's voices in this respect, especially when there are many children, and they all want to speak at once and be heard.

Perhaps it would be a good rule to listen first to the one who spoke most quietly and nicely. We have a little girl who can speak nicely when she tries, and we call that voice, after her real name, her Monica Mary voice; she also has a less pleasant voice which she uses when she is rather cross, and we call that her Jezebel Jones voice, after the name of the naughty little girl whom we suppose also to live inside her skin. Now, the rule—and a very good one—is that she never gets anything when she asks for it in the Jezebel Jones voice, but that we do our best when she uses the nice one. Long after we are gone, perhaps people will be grateful to us for having encouraged her to speak with a beautiful voice that gives pleasure and rest and peace to the people around her.

THE NOISES OF GREAT CITIES THAT ARE SPOILING THE MUSIC OF OUR VOICES

A second special reason why voices lose their beauty is the growth of cities and their noises. The louder the noises around us, the louder and more piercing our voices have to be, and the music of them deteriorates, both in the quality of the notes and in the pitch of the notes. When there is a noise going on all around us, we have no time to make our voices pleasant; we have to be heard. This question of noise naturally affects very much the voices of different classes of people. A person who speaks

in a high-pitched, harsh tone—as if he scarcely expected to be heard, but meant to have a try—tells us something about himself and his surroundings. Contrast that with the woman who speaks in a voice rather low-pitched, quiet, and musical. In so doing, she almost tells us—does she not?—that she is accustomed to live in surroundings of peace and quiet where people do not interrupt each other, where no one shouts, and that she, indeed, would rather not be heard at all than make distressing noises. In perhaps the most heart-breaking scene he ever wrote, Shakespeare makes poor King Lear say of his daughter Cordelia: "Her voice was ever soft, gentle, and low, an excellent thing in woman."

To some children who read these words, this may appear not very important; but if we wait until we are unhappy, or until we are ill, or until we have to live with one and the same person all our life, then we shall find out what a difference it makes.

THE GREAT VALUE OF CULTIVATING A SOFT AND GENTLE VOICE

There are doctors and there are nurses who are worth far more than others are to their patients, not because they are cleverer or more conscientious, but because they have the kind of voice that often goes half-way to making a sick person well.

If the quality and use of the speaking voice were entirely a matter of the shape of the larynx, or voice-box, itself, then it would be quite useless to discuss this question; but, in point of fact, the results depend upon deeper things than these, and very often the voice expresses nothing less deep than character. Children are wise in this respect, and often make very good judgments about people by their voices.

Every year hundreds of thousands of dollars are spent on singing lessons and on listening to singers. That is all very well in its way, but it is a curious thing that so few of us trouble at all about speaking lessons or about making any conscious effort at all to speak nicely. Parents will cheerfully spend large sums of money on having their children taught to sing, and will, at the same time, allow those children to talk regularly in a way which would distress any dog. We already know upon what the pitch of the voice depends, and we know, too, that a tone of any given pitch may have different shades of color, or quality. This is, at first, not easy to understand, but it becomes clear as we study sound in the STORY OF THE EARTH.

WHY WE CAN SING THE DIFFERENT VOWELS ON THE SAME NOTE

The fact is, that when we speak or sing on a given note, that note is really a mixture of a large number of notes. The lowest of these is the principal one, and is the one we hear best. But mixed up with it there are several others, called over-tones, which color it and give it its quality.

Now, we all know that it is possible to speak or sing any of the vowels on the same note. When we read this, we should quietly say or sing *a, e, i, o, u* to ourselves on the same note—and, of course, these are by no means all the vowel sounds that there are. Now, if these are all on the same note, what makes the difference between them? The whole difference between the vowels consists of a difference in the number and proportion and comparative loudness of the over-tones. When we sing *a, e* on the same note, the difference is that when we make the *e* we do something which alters the over-tones that made *a*; and so, again, when we change the tone to *o* or to *ah*, or to any other.

If we carefully notice when we do this, we shall feel that something is happening inside our mouths. We are moving our throat in a different way; we change the position and the shape of the tongue, or, in some cases—as when we change the sound to *o*—we move the lips.

HOW WE CAN MAKE DIFFERENT SOUNDS BY MOVING THE VOICE ORGANS

In all these cases the larynx is unchanged, and the vocal cords are just doing what they did at first; but we are altering the shape of the spaces above the larynx—the *resonators*, as they are called—and so the over-tones are changed, and, instead of the particular set of over-tones which we have agreed to call *a*, there comes another which we have agreed to call *e*, and so on.

Children learn to make these sounds by imitation. That, by the way, is no explanation of how it is done, but still it is done. Now, youth is the time

for learning, and afterwards not only is it difficult to learn new things, but also it is difficult to unlearn what we learned in youth. Different languages have different vowel sounds. Probably, on the whole, none of them is more difficult to learn to pronounce than any of the others. The question is really at what time in our lives we are asked to do so.

Every nation calls the sounds of the words of every other nation jaw-breaking for this reason. In English, for instance, we do not have the vowel sounds represented by the German *ü* or *ue*; nor has our *o* exactly the same sound as the Italian *o*. So we find it very difficult to make those sounds when we try to speak those languages, and, as a rule, we do not make them rightly. We may talk very good German or Italian, but the German or the Italian knows very well that these are not the languages we learned from the cradle.

WHY A FOREIGNER CAN NEVER SPEAK ENGLISH PERFECTLY

In just the same way, a foreigner may use English far more cleverly and wisely than the English do, but though he may live half a century in America, and though he may be a very musical person, yet he will not make his vowel sounds quite correctly. The lesson of this is to teach us how marvelously delicate are the tiny movements of tongue and throat and cheeks and lips which decide the difference between *ham* as we say it, and *ham* as a German, speaking English, says it.

Another of the consequences of the fact that children learn by imitation is that if people, as children, have unfortunately heard the vowel sounds not quite rightly made, it is hard work, and perhaps impossible, for them ever afterwards to get them quite rightly. Now, to make the vowel sounds properly is a mark of having a delicate ear, and of having been surrounded by people who cared about these things, and so, though a man may speak beautifully and be a wicked man, or talk with a "shocking accent," as we say, and be a hero, it is worth while, perhaps, to pay more attention to this matter than many of us do. The number of possible vowel sounds is quite large, for every possible position of the parts of the body concerned in speech will alter, by affecting the over-tones, the sound produced by the vocal cords, and so each of these positions will correspond to a different vowel sound. But, as we know very well, speech consists not only of vowel sounds, but also of consonants, like *b*, *c*, *d*, *f*, *g*, and so on, and of these, also, there is a large number.

THE DIFFERENCE BETWEEN A VOWEL SOUND AND A CONSONANT SOUND

The first thing for us to learn is, what makes the difference between a vowel and a consonant, and there is no doubt at all as to the answer. The difference between a vowel and a consonant is the difference between a muscial note and a noise—that is to say, the difference between a series of regular sound-waves and an irregular disturbance of the air. All the vowels are musical notes; to be more accurate, they are blends of many musical notes—the principal one and its over-tones. Now, *i* and *o* are just as much musical notes as *a* or *ah*; but if, instead of saying *ah*, we say *ark*, we are using a consonant, and it takes very little time to prove that we are now making a sound which is not a musical note at all, but a noise. There are many proofs of this.

For instance, the ear tells us the difference in pleasantness between a language full of harsh consonants, such as German, and a "liquid" language, as we say, like Italian, where two consonants of different kinds are scarcely ever allowed to be next to each other, and where the most is made of the vowels. In general, the higher the proportion of vowels to consonants in a language, the more musical we call it.

SOME SOUNDS THAT NOBODY IS ABLE TO SING

Again, we know that it is possible to sing a vowel, and though we may sustain the note for many seconds, we are all the time quite certainly producing the sound of that particular vowel—if we sing properly. But no one can sing a consonant, because every consonant is really an interruption, and nothing else, to the musical tone produced by the larynx. We seem to sing the letter *m*, it is true; but, in fact, when we listen to ourselves, we find that, after the first instant, we are simply singing through our nose a note which is neither *m* nor anything else. This fact of the

nature of consonants, as compared with vowels, is very important, both for the singer and the speaker, but in quite different ways, and everyone who speaks or sings knows the difference.

WHY A SINGER LIKES TO SING IN ITALIAN

The first business of the singer is to sing—that is to say, to make music. But the singer is, as a rule, asked to sing words, though sometimes he may be allowed to sing for a little while a mere vowel like *ah*; and words are made up of vowels and consonants—that is, of sounds which are themselves musical, and sounds which are the very opposite of musical; some very unmusical, like *s*, and some less so, like *l*.

Thus, for choice, the singer will use a language, such as Italian, where the proportion of vowels to consonants is high, and when the consonants *do* come in, which, of course, they must if what he says is to be understood, he makes a point of dealing with them very quickly. Let them be definitely uttered, so that the people may hear what is being sung; but let this be done very quickly, because they are noises interrupting the music—every one of them. When we begin to learn to sing, we are all liable to try to sing on the consonants, and the first thing we have to learn is to do the singing on the vowels, which alone can really be sung. It is interesting to note, by the way, that the air-waves made in singing, and even in speaking, will throw scattered powder into patterns, and on page 4092 are some pictures drawn by the human voice.

THE GREAT IMPORTANCE TO A SPEAKER OF PRONOUNCING HIS CONSONANTS WELL

To return to speaking, the first business of a speaker, as contrasted with a singer, is to be understood, and when we come to study the words of any language, we find that the differences between them are due more to consonants than to vowels. The rule for the speaker, therefore, is exactly the opposite of the rule for the singer. Whatever happens, he must make no mistake about his consonants. He must not drop his voice at the ends of sentences or at the ends of words. It may be just at the end of the word that the consonant comes which tells people what the word really is. The fortunate and rare speaker is he who manages to sound his consonants so clearly that he can be understood, and yet is not compelled to sacrifice all the music of his vowels. It is a delight to listen to such a speaker, for he satisfies both needs of his audience—the need of pleasant sound and of understanding without effort.

We do not need to study the consonants very long before we find, either by noticing what happens in ourselves or by looking at other people, that they can be classed. Certain parts of the organs of speech are specially used in making one set of consonants, and other parts in making other sets. For instance, we notice that we make *p*, *b*, and *m* with our lips, and so they are called the *labial* consonants, after the Latin word for lip. The first two we make by a little explosion of the lips, the difference between them being due not to the violence of the explosion, but to the quickness of it.

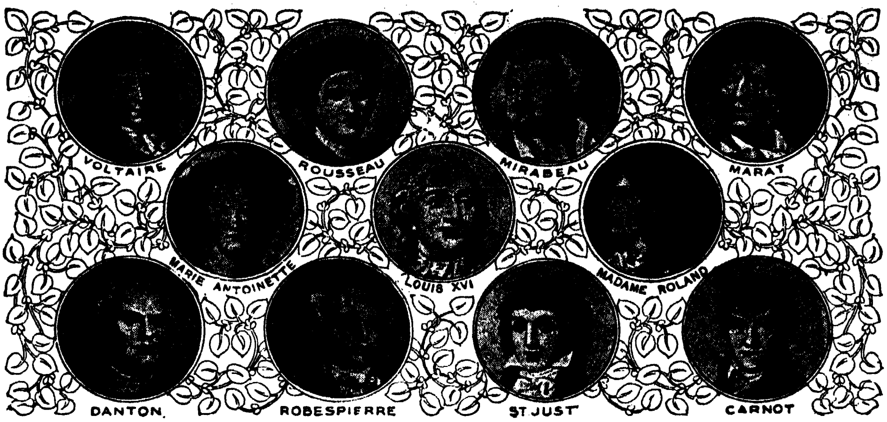
THE USE OF THE TONGUE AND THE TEETH IN PRONOUNCING OUR WORDS

Then we notice that the tongue is mainly used in the making of such vowels as *l* and *r*. There is certainly no doubt about the *r* if we roll it. Then there are certain consonants where there is no doubt that we use the teeth, as, for instance, *d* and *t*, and these are called dentals; and there are others, such as the sound *ng*, in which we evidently use the soft palate—that is, the back part of the roof of the mouth. So we call that a palatal consonant.

The larynx has nothing to do with the consonants, for, as we have seen, its business is to produce musical tones. We have also seen that the quality of sound produced decides the vowel, and that this is decided by the position of the tongue, the lips, and so on. It follows that if we allow air to pass up between the vocal cords, but without using them, we can still produce all the vowels and consonants; in other words, we can whisper, and that is what whispering is.

Thus, just as there are defects in speech due to defects in the machine, as, for instance, loss of the teeth, so also there are defects due to what controls the machine, and the chief of these is what we call stammering.

THE NEXT PART OF THIS IS ON PAGE 4259.



THE FRENCH REVOLUTIONISTS

CONTINUED FROM 4083


DIDEROT

LESS than 150 years ago there were very great troubles in the kingdom of France, and violent changes took place. The French monarchy was turned into a republic, so that there was no longer a king at the head of affairs, because it was said that every country ought to be ruled according to the will of the whole people who live in it, and not according to the wishes of one man or of the few who have wealth and power. After all, it was not very long before the French found themselves again being ruled by the will of one man, who became the Emperor Napoleon Bonaparte, of whom we read in other parts of this book.

But the changes which took place before that make up the story of what is called the French Revolution. And some of these changes in the government of the country and the life of the people have continued to the present time in France itself, and some have been adopted since that time into other countries of Europe.

Now we are going to learn something about the men and women who made this French Revolution, or tried to prevent it; but we shall not be able to understand much about them unless we first of all try to imagine the state of things which made people so determined to have a change that they allowed all sorts of wicked and terrible things to be done rather than stay as they were. In England there was a free government—that is, the people ruled through the Parliament, and the king and the ministers had to obey the law like everyone else. But in France the king and his ministers could do very nearly as they liked, so long as they did not interfere with the privileges of the clergy or the nobles.

The common people suffered grievously by reason of these very privileges; for in the country places the peasants were almost the slaves of the great landowners, who were called the seigneurs. And in nearly all the land, except in Brittany and the district called La Vendée, many seigneurs cared little for the needs or the sufferings of the peasants. The seigneurs and the clergy paid few taxes, but the peasants were compelled to pay heavy taxes to the State and feudal dues to the seigneurs, which meant sometimes money and sometimes the produce of their lands. Besides all this, they had to labor for the seigneurs without pay—all of which was very unlike anything that had been known in Great Britain for more than 400 years. There were

many people who for a long time past had been saying that all this was very wrong, and had been pointing out that people in England were much more happy and prosperous, and among these we may try to remember the names of Voltaire and Diderot. But these two men did not arouse so much excitement as Jean Jacques Rousseau, who came from Switzerland. He had been brought up in poverty, and had led a strange, wandering, discontented sort of life, failing in everything at which he tried his hand, until he took to expressing his ideas in books, which at once made him famous.

The idea which he held was that civilization was all wrong, and that people would be much happier living in what he called a natural state, with very little law or government at all. He said that people who were strong and rich had persuaded the rest to serve them by pretending that they would protect them, and so had got the power to rule into their own hands, and used it for their own advantage. In this way the poorer classes were robbed of their natural rights.

ROUSSEAU, WHO TAUGHT THAT THE WILL OF THE PEOPLE SHOULD TRIUMPH

He maintained that everybody ought to make a new agreement or social contract, according to which everything should be settled by the will of the people; and that there should be no more kings or seigneurs or people who had privileges, but everything should be arranged in the way that the mass of the people thought best for themselves. This teaching of his about the rights of man and the social contract became very popular.

All the seigneurs belonged to a group of great families who kept themselves aloof from ordinary folk, and they are spoken of sometimes as the *noblesse*, and sometimes as the aristocrats. There were a few of the aristocrats who were very much in favor of some of the new ideas that Diderot or Voltaire or Rousseau were talking about. The king had not nearly enough money to carry on the government, especially as there had been great expense, owing to a war with England, and he was advized that the only thing to be done was to summon an Assembly of the Three Estates—as the Noblesse, the Clergy, and the Commons were called—to consult them as to whether better arrangements could be made for governing the country. At this time there were two men who became very notable as leaders of the people, both of whom belonged to aristocratic families—one was Mirabeau, and the other was Lafayette.

THE TWO MEN WHO MIGHT HAVE SAVED FRANCE FROM THE GREAT TERROR

It was a very unfortunate thing that these two could not be friends, for what both of them wanted was to set up in France a government in which the voice of the people should be heard, and yet let the king and his ministers have a good deal of power—more, really, than the King of England had. Both of them had learned a good deal in England or in America; for Lafayette had come to America when he was only twenty, and had served under the great George Washington in the war which ended in the separation of the United States from England; so he had seen what Americans and Englishmen meant by freedom, and also how wise and great a man Washington was.

Mirabeau had lived for some time in England, and had seen there how it was possible for justice and law to rule everywhere without any oppression, and for both king and people to have a share in the government. But the least that either of them wanted would have made so great a change in France that the court and most of the aristocrats and the clergy would have nothing to say to them. And perhaps the saddest thing is that if King Louis had been a wiser man, those three working together might have made the French Revolution a peaceful affair, which would have set up in France a government not very unlike that of England.

THE GOOD KING LOUIS, WHO TRUSTED BAD COUNSELORS

Louis himself was a good man, who wished to do what was right and just. He was a brave man, too. But he was not clever himself, and he was not like some other kings who have had the wit to choose good advizers and trust them. Instead of that, he trusted people who gave him bad advice, and could see nothing but harm in the changes that Mirabeau and Lafayette demanded when the Three Estates were assembled in what was called the States-General and

THE BIRTH OF THE FRENCH REVOLUTION

At the outset of the French Revolution, the hall in which the Third Estate met was closed to prepare it for a session which the king was to attend. The representatives of the Third Estate went to the Tennis Court and took an oath that they would never separate until the constitution of the kingdom was established.

Even after the Constituent Assembly, as the legislature was called, was recognized by the king, he and the nobles plotted against the popular cause. At last the people took up arms, and some of the troops joined them. On July 14, 1789, a day ever to be remembered in French history, they captured the Bastille, the grim fortress of Paris, and leveled it with the ground. This marks the passing of the old order of things in France.

afterwards the National Assembly. It seemed to them that to take away the privileges of the noblesse and of the clergy would be robbery, and that the proper thing for the common people was not to govern but to obey their betters, among whom was Queen Marie Antoinette.

Mirabeau understood what was needed better than any other man in France. He was a man who lived a wild life privately, and was always greatly in debt, which set a good many people very much against him; and he was so domineering that it was not easy to be friendly with him. But he was a wonderful orator; so that when the Assembly had come together bent on doing one thing, he could sometimes persuade it to agree to something altogether different. He would rouse people up to be enthusiastic when they were timid and hesitating; and in this way he had a great deal of power, though people were really afraid to trust him.

He was called the Tribune of the People, because he was so bold in demanding what he considered the people ought to have, and because he wanted the "privileged orders" to have their privileges taken away and to pay their share of the taxes.

HOW MIRABEAU TRIED TO BRING THE KING AND THE PEOPLE TOGETHER

But he saw, too, that many who had come to the Assembly had no idea of what good government meant. He felt that the Assembly was not yet fit to rule. He wanted it to have power, but he believed that the only way to prevent terrible things happening was for him to become the real ruler himself. He wanted the people to trust him, and he wanted the king to trust him; but presently it came about that, while the king suspected him of being on the side of the people and against the crown, the people, and those who had most influence with them, suspected him of being really on the side of the crown against the people, when the thing he was striving to do was to unite crown and people for the good of both.

Several of the changes which Mirabeau wanted were made, but there was really no chance of bringing the king and the people into agreement after he died, which happened before the troubles had been going on for a very long time; for he tried to do such an immense amount of work that he wore himself out, and as soon as he fell ill, death overtook him very quickly.

Lafayette was a very different kind of person. He was a very popular and high-minded gentleman, who had won great praise as a soldier when he was fighting in America under George Washington. After the States-General had come together, and had been turned into the National Assembly, it began to be very difficult to keep order, because everyone was in a state of excitement.

LAFAYETTE, WHO TRIED TO KEEP ORDER IN PARIS AND DISPLEASED ALL PARTIES

So the better class of the citizens in Paris were enrolled, as soldiers in what was called the National Guard, to keep order; and Lafayette was made their general. He was very popular among them, and some people began to think that Lafayette meant to make himself the real master by the help of his soldiers, like Julius Cæsar in Rome or Oliver Cromwell in England. Besides, it was not very easy for the ordinary people to believe that so fine a gentleman as Lafayette cared much about them; and the noblesse hated him because they thought he had deserted their order; and the queen and court disliked him because they thought he was trying to become dictator. At last, when there was a great riot, and Lafayette had to order his soldiers to attack the mob, the common folk liked him less than ever, and he found that even his soldiers were only half inclined to obey him. He always wanted to check violence; but he could not sway men as Mirabeau could sway even those who did not trust him. So when more violent men got the upper hand, Lafayette no longer commanded the National Guard. Later on, when France declared war against Austria and Prussia, he was sent to command the French army; but Paris became so disturbed that he wanted to take the French troops back there, and when he found that he could not do so, he would not remain in command, but left the country.

HOW LAFAYETTE HELPED TO BRING BACK A KING TO FRANCE

As for what befell him afterwards, he was made prisoner by the Austrians, and after spending some years in prison he was set free. Later, he helped in the restoration of the Bourbon king;

THE ROYAL FAMILY CAPTURED BY THE MOB

With the fall of the Bastille the power of the French king was gone, for the destruction of that relic of tyranny showed the people their strength. Louis XVI. was brought from Versailles to Paris by the mob, and was little better than a prisoner in his palace. At last he determined to escape with his family from Paris, but when the royal fugitives reached Varennes they were recognized and stopped, as shown in this picture.

The king and royal family, after their attempted flight, were brought back to Paris and carefully guarded in the Tuileries. Led by demagogues, the mob gradually became violent, and on June 20, 1792, the anniversary of the oath in the tennis-court, forty thousand people marched to the Tuileries, burst into the palace, and insulted the royal family, as shown here. The queen is standing with her children behind a table.
This picture is from the painting by the well-known artist Alfred Elmore, R.A., by permission of the Art Union.

THE LAST DAYS OF THE KING AND QUEEN

Encouraged by their growing power, and exasperated by the foolish threats of the nobles and princes who had escaped from France, the leaders of the people decided to remove the royal family to the close confinement of the prison of the Temple, and to destroy all aristocrats. In two or three days over a thousand prisoners were massacred, and no one knew how long he or she would be safe from the dreaded guillotine.

At last, on September 21, 1792, the monarchy was abolished in France, and a republic proclaimed. Shortly afterwards the king was separated from his family, brought to trial, and beheaded. The Reign of Terror was now in full force, and, in the following year, Queen Marie Antoinette was also tried and condemned to death, as shown here. Whatever may have been her early follies, at her trial she acted in every way like a queen.

FALL OF THE REVOLUTIONIST LEADERS

In the French Revolution, so soon as one set of men obtained power they were destroyed by another set more extreme. The most bloodthirsty party was that of the Jacobins, who destroyed the Girondins. One of these Girondins was Madame Roland, a beautiful and clever woman, who did much to direct the Revolution. But she was imprisoned by the Jacobins in the prison of Saint Pelagie, as shown here, and then beheaded. On the scaffold she exclaimed : "O Liberty, what crimes are committed in thy name!"

The Girondins had been allied with the Jacobins, and together they overthrew the monarchy. But in the massacres of prisoners by the Jacobins the Girondins had no part, and, indeed, they tried to prevent the bloodshed. When the Jacobins, who were cruel and bloodthirsty, felt themselves sufficiently powerful, they sent the Girondins to the scaffold in large numbers, as shown in this picture. The mob in Paris enjoyed seeing the victims go to execution, and mocked them as they went through the streets to the scaffold.

The picture of Madame Roland at St. Pelagie is by Edouard Carpentier, and the lower picture is from a painting by the French artist Piloty.

and, at the end of his long life, he helped in another little revolution when Charles X. was put off the throne and his cousin, Louis Philippe, was made king in his place.

Now let us look at the king and queen, whose story is so tragical. Louis always meant well, and would have been quite willing to grant much more power to the people, and to put an end to bad laws and customs; but the people round him were always persuading him that if he allowed one thing or another to be done, the king would never again have any power; and Louis thought that a king had no right to give up his power. So he could never make up his mind either to trust Mirabeau or any other of the leaders of the people, or, on the other hand, to take up his stand boldly as a monarch who was determined that his own will should be obeyed. In one way he was a brave man, for he had no fear of death, but he had not the other kind of courage which enables a man to resolve on a plan of action in which there are risks, and to carry it through in spite of dangers and difficulties.

HOW THE KING AND QUEEN TRIED TO ESCAPE FROM FRANCE IN THE DARK

Soon after the death of Mirabeau, the king and queen thought the best thing they could do was to take flight out of France, and then perhaps other kings would help them to recover their power, for the queen was the sister of the Emperor of Austria.

They made preparations secretly, and fled by night from Paris in a carriage, pretending to be just a gentleman and his wife. But at a place near the frontier, the king was recognized when he got out of his carriage, and they were stopped and sent back to Paris, where they were kept prisoners. Louis accepted the new constitution, or rules for governing the country, which the Assembly had prepared, and so he was still king. A new Assembly was called, but the king had no able men about him now whom he could make ministers, and the cleverest men whom he tried would not do as he wished, or serve him if he did not do as they wished. At this time, because the Austrian Emperor and the King of Prussia threatened to interfere, Louis was forced to declare war against them. And at the same time the men who were called Jacobins, which was the name of a club or association to which they belonged, were stirring up feeling against the monarchy, and Paris was becoming very much excited.

A MOB THAT BROKE INTO A PALACE AND MADE THE KING WEAR A RED CAP

One day there was a great procession, which found its way into the royal palace of the Tuileries; and the King of France was obliged to set on his head the red cap of liberty. The queen, too, had to set one on the head of the little Prince Royal, the heir to the throne. No real harm was done that time; but when ill news came from the war, and the Prussians made a proclamation that Paris would be punished if the king were hurt, the people became furious. The royal palace was attacked by a mob thirsting for blood; the valiant Swiss Guards, who defended it stoutly, were cut to pieces. But the king and queen had fled with the rest of the royal family, and taken refuge with the Assembly. Then, later, there came another new Assembly, which was full of Jacobins, and of others who wanted a republic, who were called Girondins; and the new Assembly proclaimed that France was now a republic and the king and queen were merely citizens. And even before this the Jacobins had put to death a number of royalists, or supporters of the king, who had been thrown into prison, in what were called the September massacres. The next thing was to bring the king himself to trial, as Charles I. had been tried in England just 140 years before. He was tried by the Assembly itself, and condemned to death.

A ROYAL PRINCE WHO VOTED FOR THE KING'S DEATH

Like Charles the First, Louis showed a royal dignity and fortitude. He was beheaded, not with an axe like Charles, but by an instrument called the *guillotine*, which had been brought into regular use in France by this time. King Louis's own cousin, Prince Philip of Orleans, was one of those who voted for his death.

The poor queen and her children remained prisoners for a long time. Marie Antoinette greatly deserves to be pitied, for though she had not always been wise, yet, when misfortune came upon her, she behaved with splendid courage; and it has always been counted among the wickedest deeds of the Jacobins that she,

THE END OF THE LEADERS OF THE TERROR

The most ferocious villain in the Reign of Terror was Marat, one of those monsters whom Nature rarely produces. Even his bloodthirsty associates shunned him, and his very appearance struck terror. A beautiful young woman named Charlotte Corday, whose lover Marat had caused to be assassinated at Caen, determined to rid her country of such a ruffian. Going to Paris, she went to Marat's house and stabbed him.

Less ferocious, though not less thirsty for blood, Robespierre was for a time the leader of the Terror, and day after day victims went to the guillotine, until at last his associates and the people became tired of so many executions. Robespierre was denounced, arrested, and suffered on the guillotine to which he had sent so many others. With his death the Reign of Terror ceased, and gradually peace and safety returned.

Photographed by permission of Messrs. Braun Clement and Company.

too, was sent to the guillotine by them, nearly a year after her husband.

She was not yet forty years old when she was slain; but the long, terrible months of anxiety had changed her so, that she seemed almost an old woman. When she became Queen of France, she was a beautiful and attractive girl who had never known what it was to have her will crossed, and had been taught to take it for granted that kings and queens have a right to go their own way, so that she always encouraged the king to resist. When she died, she died like a queen.

One woman is famous who was on the side of the Revolution. The party who wanted a republic in France was divided into two sections called the Girondins and the Jacobins; and of these the Jacobins were much the fiercer. For the desire of the Girondins was to have a republic like that of ancient Rome; they did not wish to destroy for the pleasure of destroying.

THE NOBLE MADAME ROLAND, WHO DIED BECAUSE SHE TRIED TO SAVE OTHERS

Among the Girondins, Madame Roland had great influence, and was accounted a woman both noble and wise. But after the king had been slain, the Jacobins got the upper hand altogether, and turned upon the Girondins, who wished to check bloodshed. Many of them were flung into prison, among whom was Madame Roland; and many were sent to the guillotine, though they had striven their hardest for liberty. And so it was that Madame Roland died in the same way as Marie Antoinette.

We have not much space left for talking about the men who wrought the worst evils in the Revolution. There are three who are commonly named together, and of these one came very near to being a great man. This was Danton—terrible, fearless, ruthless. It was he who caused the September massacres, because he thought that was the only way to make sure that there would not be a rising of the royalists, just at the moment when it seemed that foreign armies might be marching on Paris. And it was he who spoke these fierce words, when the kings of Europe seemed to be gathering their forces to crush the French Republic: "To the kings, we will fling down the head of a king as the gage of battle"—meaning that Louis should be beheaded. After that he would have joined hands with the Girondins in checking bloodshed, but they would not join with him; so he held by the Jacobins, yet still strove to stay their bloodthirstiness, desiring only to slay when he thought it needful to make opponents afraid. And again the more cruel among them got the upper hand, and Danton, in his turn, was sent to the guillotine.

HOW A YOUNG GIRL RID FRANCE OF A BLOODTHIRSTY TYRANT

The second of the three was Marat, who called himself the "friend of the people," foul of speech, craving for blood, ever urging death for the aristocrats. He did not die by the guillotine, for his wickedness so stirred the heart of a girl named Charlotte Corday that she thought it was her mission to free the world from such a monster. So she came to Paris, and, being admitted to speak with him, drew a dagger and slew him; for which deed she, too, gave up her life under the guillotine.

The third was for a time the most powerful of them all. This was Maximilian Robespierre, a little, unhealthy-looking man, who would have been simply a very respectable citizen if he had remained in private life. But he had one idea in his head which he was quite determined to carry out. This was that the will of what he called the "Sovereign People" must rule, and the way to bring that about was to destroy everything that could possibly stand in the way—kings or aristocrats, Girondins or Jacobins, men or women, young or old. He got all the power in his own hands, till at last, week after week, the guillotine was killing fifty people every day.

THE END OF THE TERROR AND THE DEATH OF ROBESPIERRE

Then even his own supporters grew weary and disgusted, and turned upon him; and he, too, went to the guillotine. When his head fell, those who stood by shouted for joy. With his death, the Reign of Terror came to an end, and the ruling of the French Republic passed into the hands of a group of people called the Directory. How in after time Napoleon Bonaparte first served the Republic, and then overthrew it and made himself emperor, we read on another page.

THE NEXT MEN AND WOMEN BEGIN ON 4155.

WHERE DOES DUST COME FROM?

CONTINUED FROM 4024

DUST is matter that has been ground or worn down into tiny separate pieces, like the sand in the desert, of which some pictures are shown on 4118 and other pages. If there is much water about, it catches the dust and makes it into mud; and then, when the mud dries, it is blown into dust again. There can be no dust at all on the moon; nothing is worn down into dust there. The forces that make dust on the earth are air, especially moving air that we call wind, and water. These are, perhaps, helped a little by the power of light. Of course, different kinds of things differ in the ease with which wind and rain can grind them down into dust, and so we find less dust in some places than others, even though both are equally exposed to wind and rain.

In places where men's feet or wheels of carts and carriages are traveling over and rubbing the ground, much dust is also made by them. That is one reason why cities are so dusty in dry weather. Water-carts lay the dust, because water is heavy, and when a speck of dust is soaked in water, it can scarcely be blown about in the air. In cities, also, much dust is made in the roads by horses, and it is probable that this is very bad for people's throats and eyes. But the most dangerous dust of all is the dust made by the spitting of consumptive people, and this really is one of the principal ways in which tuberculosis is spread. Many people have worked hard for a law to prevent people making this deadly dust. Now in most cities there is a law against spitting in trains and street-cars and other public places.

DO WE GROW JUST AS MUCH ONE YEAR AS ANOTHER?

Certainly we do not. For one thing, whenever we have an illness our growth is affected—usually it is lessened; but sometimes it may be increased, and that makes a difference to our growth in that year. But even if we have no illness, and live exactly even lives from year to year, our rate of growth varies very much.

Both boys and girls, but especially boys, grow much more in the years from about fourteen to seventeen than they do at other times. Growth in height depends almost entirely on the lengthening of the bones of the legs; and it is the differences in the length of the legs that makes the difference in people's heights. That is why we cannot tell how much people differ in height when

they are all sitting down. The bones of the legs grow in length by the making of new bone at certain places near their ends. After about the age of eighteen most of these places stop working, and only those which are left can add to our height. Some do not grow much after eighteen. A few years later the rest of these places stop working, and the whole length of the bone becomes finally fixed. Some grow much more slowly after the age of seventeen or eighteen.

WHY DOES A LIGHT GO OUT IN WATER BUT FLARE UP IN KEROSENE?

Water is burned, or oxidized, hydrogen. Being already burned, it can be burned no more. When a light is dipped in water, it is deprived of the oxygen by which it is burning, just as a drowning man would be. There is a little oxygen dissolved in water, enough for fishes to burn or breathe by; but this is not enough to support a light. Perhaps it might be, but that water is a very quick and good conductor of heat. So when a burning thing, or a hot glowing thing, like a red-hot wire that is not burning, is plunged into water, it very rapidly loses a lot of heat to the water, and so it is lowered to a temperature at which it cannot burn, or glow, as the case may be.

But kerosene is a compound of carbon and hydrogen, each of which is very ready to combine with oxygen—that is, to burn—when it is made hot enough. A light put into it does this, and so the light flares up, because the kerosene begins to burn. The products of its burning are water, H_2O, and carbon dioxide, CO_2; and when the paraffin has been changed into these two substances, it can be burned no more.

HOW MANY WORLDS ARE THERE?

This question could only be answered if we knew that we could see, or somehow knew without seeing, all the worlds there are. But all we can see, or otherwise discover, are doubtless nothing to the whole number of worlds. By means of photographing the light that comes through telescopes, we can discover not less than one hundred millions of bright worlds in the sky. If we had larger telescopes or more sensitive photographic plates, we should discover more, and every year we do discover more worlds. Still, one hundred millions of bright stars is an easy figure to remember.

Then we can prove the existence of a large number of stars which have "gone out," and are now dark and cold. But it is only a very tiny proportion of the dark stars of which we can *prove* the existence by their effects on the movements of the bright stars, and, so far as we can judge, the bright part of a star's history must be very short compared with the dark part. So we should require to add probably thousands of millions of dark stars to correspond to the bright stars that we know. Then our own sun has many large planets and moons circling round it, and hundreds of very tiny planets. If other stars have the same number, on the average, round them, we see that the huge number of worlds grows greater still.

WHERE DOES OUR WARMTH COME FROM?

Our warmth is all the result of the burning that goes on ceaselessly within our bodies. We do not realize how much this burning is, for we do not realize how much heat we are always losing from our bodies. If we lost no heat from our bodies, they would become as hot as boiling water in a very few hours. All this heat is made by the burning of our food. It burns, as other things burn, by combining with oxygen, and that is brought into the body by our breathing. The chief part of the burning that produces our heat occurs in our muscles and in a large gland, the largest in the body, called the liver.

We may think of the muscles as the fireplaces of the body, and the fuel burned there is mostly fat and sugar. A great deal of heat is produced when a muscle contracts, and that is why hard exercise makes us so hot; but, even when the muscles are still, this burning and making of heat are always going on. The liver, too, is always active, and we know that the blood leaving the liver is considerably hotter than the blood going to it.

Though all parts of the body do not produce equal warmth, they are all kept at just about the same temperature by the circulation of the blood—which takes heat from the hottest places, such as the liver, and gives it to the coldest places, such as the fingers and toes.

WHAT DID THE FIRST LIVING THING IN THE WORLD EAT?

This is one of the most important of all the questions that have to do with

the beginning of life on our planet. When we study the food of animals, we find that they all, without exception, depend for their food upon the work done by other living creatures—either plants or other animals that live on plants. Therefore we are quite sure that the first living creatures on the earth cannot have been animals. Even if animals had been brought to the earth from some other world, there would have been nothing for them to eat, and they must have died of starvation.

Now, when we study the food of plants, we find a great difference. They can live entirely on things which have been made, or can be made, in the air and in the soil, without the action of life of any kind. Hence we know that plants must have lived before animals on the earth, and that the first living creatures must have been plant-like.

We say *plant-like*, rather than *plants*, because they were, perhaps, very different from any plants that exist on the earth to-day — perhaps simpler than the simplest living cell we can find anywhere. And, like most plants of to-day, they must have lived upon water, the carbon dioxide of the air, and the various salts, not needing to be made by the action of life, that are found in the soil. Important above all must have been the salts containing nitrogen, washed down into the soil by the rain from the air when they began to be made through the action of electricity in the oxygen and nitrogen of the atmosphere.

IF RADIUM COULD BE TAKEN TO THE NORTH POLE WOULD IT CHANGE THE CLIMATE?

In answer to this question we must be allowed to ask: How much radium? Of course, it all depends on that. A little radium produces only a little heat, though a very great deal in proportion to its quantity; while a lot of radium produces a lot of heat. If we could take a quantity of radium to the North Pole, beyond any doubt it would alter the climate there for thousands of years. If enough were taken it would make a tropical climate everywhere.

The time may quite well come when men may change the climate of the colder parts of the earth in some such way as is suggested—perhaps for the first time —in this question; and in the days to come men will need to make every part of the world habitable that they can, for the number of human beings in the world is always increasing. But if all the radium that has been separated from the things among which it is found were gathered into one room, no one would notice any difference in the temperature of the room, so small is the amount of radium that the chemists have yet extracted. It will certainly be a long time yet before there is enough radium collected to weigh a pound, and then that pound will be worth an enormous sum of money, for it will have cost years of labor to collect. But the time may come when we shall learn how to make radium from other elements quite easily, and then the sort of thing that is suggested in the question will be quite possible.

WHY IS GOLD NOT FOUND IN ENGLAND?

This is really a special way of asking a general question. Why do we find the various elements where we do, and not elsewhere? We are only just beginning to get the knowledge which will perhaps some day enable us to answer this question. Until quite lately, most people thought that the elements, such as gold, had always existed as they are now, and so there was no use in asking the question: Where did they come from?

If we thought this, we could never hope to say why gold is found in certain parts of the world and not in others. But now we are beginning to learn that the elements have a history. In a few years we may learn how gold came into existence — from what other element or elements it was formed; and so in time we may hope to learn how to explain the present distribution of gold and the other elements in the earth's crust.

We must always remember that gold, like most elements, is much more widely distributed than most people suppose. We usually only hear about the presence of a precious element anywhere when there is enough of it to pay for getting it out. But gold occurs in traces almost everywhere, just as the far rarer element, radium, does. It is found in sea water everywhere, and even in some kinds of earth in parts of England; but there is not enough to be found to pay for the trouble of getting it out.

IS THERE ANY OF THE HISTORY OF ENGLAND UNDISCOVERED?

Certainly there is. Of course, we do not mean its recent history, for that

goes back only about two thousand years, and it must be many thousands of years since England was broken off from the Continent of Europe by the English Channel. There are only Stonehenge and one or two more such places to help us with the history of England as it was long ago, and Stonehenge tells us that a very clever race of people, who knew a lot about the skies and who could raise huge stones, lived in England 1,600 years before the birth of Christ; and that is all we know about them. We do not know what became of them, and we do not know where they came from—whether they sailed across the sea, or whether their ancestors were already in England when England became an island.

Plainly, we cannot say that all the history of England is discovered when we do not even know how the first men got into it. The part of the island's history that we know is only like the history of yesterday compared with the vast part that must now be lost for ever.

WHY CAN WE OFTEN SEE THE WHOLE CIRCLE OF THE MOON WHEN IT IS NOT SHINING?

The reason is that the earth shines brightly by the sun's light, just as the moon does; and the earth's light is enough to light up the moon, so that we can sometimes see even the part of its face that is not lit by the sun.

There is a very curious and celebrated mistake in a famous English poem, which shows that the poet did not at all understand the moon, and apparently had never seen what we have seen. It is "The Ancient Mariner," by Coleridge. He speaks of

> The hornèd moon, with one bright star
> Within the nether tip.

Of course, no one ever saw a star within either tip of the crescent moon, because the rest of the moon is there, and would hide the star. The nearest star is, of course, many millions of miles farther away than the moon. If Coleridge had ever seen the moon as described in this question, he could not have made such an extraordinary mistake.

WHY CAN WE NOT SEND A LETTER WITHOUT A POSTAGE STAMP ON IT?

Well, there is no reason why we should not send all our letters without stamps on them, provided that we could find some hundreds of thousands of people to do the work of postmen and sorters and post-office officials, and railway servants, and that we could get other people to make and maintain railways and engines, and to dig coal to drive engines—and a few other things like that—all without payment. We write a letter and drop it in a letter-box, and it reaches our friends a hundred miles away, or perhaps in Australia, and we think no more about it. But an enormous amount of human labor is required. If we think of sending a letter to England, which we can now do for 2 cents, we must include all the work of the men who make the ships and the compasses, the sailors who work them, and the people who make the harbors. If these things did not exist, it would cost thousands of dollars to send a letter across the world; and railways cost so much to make that it would cost thousands to send a letter quickly even across America.

But as millions of people have letters to send, and as we can always count on their continuing to want to send letters, preparations can be madé, and then their millions and millions of pennies, put together, will pay for everything, and enable each of them to send a letter thousands of miles for 2 cents. So the question we should have asked is not, Why can we not send a letter without a postage stamp on it? but, Why does it not cost ten thousand dollars to send a letter?

CAN ANYTHING TRAVEL FASTER THAN THOUGHT?

We sometimes say "as quick as thought," as if thought were the quickest thing in the world; but that is very far from true. When we think, waves of something—we can only call them nerve-currents—travel along the nerves inside our brains. So if we want to measure the speed of thought, the best way to do so is to measure the rate at which a nerve-current travels along a nerve.

This cannot possibly be done directly in anyone's brain; but we can do it in other ways. We can take a long nerve, such as we find in the arm or the leg, and by the use of delicate electrical clocks we can find how fast it carries its messages. About the speed of an express train is what we find. That is very slow compared with the speed of the earth, and slowness itself compared with the speed of light. So "as quick as lightning" means far more—*millions* of times more—than "as quick as thought."

Now we can do another thing. We can find out how long a person takes to distinguish between, say, a red color and a black color. When he sees red he is to do a certain thing, and when he sees blue he is to do something else—as quickly as he can. We can measure exactly how many hundredths of a second this takes to do; then we can subtract the time taken in running to and from the brain, and we find that most of the time was spent in the brain—spent in the thinking. So we must conclude that thought is not really a speedy thing at all; but we must remember that speed is not everything.

WHY DOES A HEN NOT CROW?

When we study birds, we find it a general rule that the male birds are the most brightly colored, and it is the male birds that sing. The feathers of the female birds are usually less bright, and their voices are not so melodious. It is probable that both the bright coloring of so many male birds—compare the peacock with the peahen—and their singing are things that have been evolved to make them prominent and pleasing in the eyes of the females. Among animals it is usually the females that choose the males they like best, which are usually the finest specimens of their kind; and it would certainly be better for the progress of human beings if that were more the rule among ourselves also.

We may say that the crowing of a cock is not to be called singing, and certainly it is a very ugly noise compared with the singing of the lark, or the thrush, or the nightingale; but still it is really the cock's way of singing, and probably it gives pleasure to the hens. Even among ourselves the notion of what is nice singing varies very much with different people, and the hen has as good a right to her opinion of the cock's singing as we have.

WHY DOES A NEWSPAPER STRETCHED ACROSS A GRATE MAKE THE FIRE BURN UP?

The effect of the newspaper is really the same as the effect of blowing the fire with a pair of bellows. All burning depends on the supply of air. The more quickly fresh air—that is, the oxygen in the air—is supplied, and the more quickly the gases produced by the burning are blown away from the fuel, the more brightly will the fire burn. The fire makes a draught for itself up to a point, for the gases it produces are hot, and so rise, while fresh air comes in to fill the space they tend to leave empty. If we want a very hot and quick fire we make a forced draught, as we do when we use a pair of bellows. The newspaper greatly increases the draught of air through the fire, by preventing any air from getting up the chimney except by first passing right through the fire from below the grate.

The air usually travels up the chimney when a fire is lit at the rate of about three feet in each second. That is why a fire helps to ventilate a room. But much of this air gets into the chimney above the fire and does not help it to burn at all. When we use a newspaper we stop this; and the air has to pass quickly right through the grate. It is one of the stupid things about an ordinary fire, accounting for most of the smoke it makes, that we pile the fresh fuel on the top, where much of it is blown up the chimney unburned, by the burned gases of the fire, instead of adding it at the bottom, where the fresh air can act on it.

WHY IS IT THAT PURE OXYGEN WILL KILL US?

This question rather reminds us of the lawyer's question: "Have you left off beating your wife?" No matter whether the man answers "Yes" or "No," he is in a difficulty. A question like this is what students of language call a double question, and we must always be on the look-out for such questions. The lawyer assumed the answer "Yes" to another question: "Have you ever beaten your wife?" And here you are assuming the answer "Yes" to the question: "Does pure oxygen kill?"

Pure oxygen does not kill. It may be breathed for hours with the greatest benefit by persons who are ill, and it often helps to keep them alive. It is used for this purpose all over the world every day. It is quite reasonable that if a person cannot breathe quickly enough and strongly enough to get into his blood all the oxygen he requires from a volume of air of which only one-fifth is oxygen, he may yet be able to get all he needs if he breathes an air, or atmosphere, which consists entirely of oxygen. When we understand how important oxygen is,

we shall see why it is that runners, and even racehorses, are said to run more quickly if they are dosed with oxygen. But we are not certain that this statement is true, or can be borne out, and it would require a great many experiments to make us sure of it. It is quite probable, however.

The notion that pure oxygen is harmful probably has an element of truth in it. If we were all taken to an atmosphere of pure oxygen, and never had anything else to breathe, our living would probably be very much disturbed; it might be that our brains would become far too much excited, and so all sorts of disasters might happen. We do not at all know what would be the effect on a healthy person of breathing nothing except pure oxygen for hours or days at a time; but we shall probably learn all about it before long.

WHY DOES A SENSITIVE PLANT DROOP WHEN TOUCHED?

When we call the plant sensitive, we mean that the plant feels, and there is no doubt that the plant does feel the touch. We must beware of thinking that the plant's feeling is just the same as our own. Yet it is believed that we ourselves can feel just as the plant does. If we look at someone—a child, or anyone else—who is asleep, and then if we move the bedclothes so that the cold air strikes the arm; or if we touch the skin of the face with a feather, the person will move. Now, something has been felt *somewhere*. It is not like the feeling of a person fully awake, but it is very much the same as the feeling of a sensitive plant.

Plants have no muscles, but they have many other ways of moving. They have elastic fibres, and many kinds of fibres which can become shorter or longer, and which, though they are not muscles, really act in much the same way as the fibres that make up muscles. As for nerves, we always think that plants have none, but we are just beginning to learn that, perhaps, they have nerves; by no means the same as the nerves of an animal, but something that does the same work.

If the question means what is the use of the drooping, then we may say that the plant protects itself by shrinking up into smaller space when it is touched. The touch, for instance, might be that of some insect which might hurt the plant, and if the plant droops, perhaps the insect will miss it, and turn to some other plant that does not droop.

WHY ARE THERE NO GREEN FLOWERS?

Every part of a plant has its business, its own special purpose in serving the life of the plant. The leaves exist in order that the plant may get the kind of food it needs from the air, and the green stuff of the leaves is necessary, as we know, for this purpose. The flowers of the plant have a wholly different purpose. They exist, not for the sake of the plant that bears them, but for the production of new plants that shall carry on the life of the parent plant when it is dead. The part of the flower that is usually most conspicuous is the petals, and these, as we learn when we study the way in which the plant develops, are changed or modified leaves.

But they are not green, because, firstly, the plant produces plenty of green leaves in other places; and, secondly, because if they were green they would not be noticed by insects. The plant usually depends upon the visits of insects to its flowers in order that it shall get from some other plant of the same kind, which the insect has already visited, what it needs to fertilize its flowers, so that the seeds in them shall grow into new plants. The insect is therefore helped to find the flowers by the color of its petals being different from the color of the leaves.

IS CHLOROPHYLL THE COLORING MATTER IN RED FLOWERS?

No; the coloring matter of red flowers, and of flowers in general, whether red or blue or white or yellow, is not chlorophyll, but something else, the nature of which differs in various flowers. The business of chlorophyll is to feed the plant by means of sunlight; but the business of the flower is not at all with the feeding of the plant; the flower does not exist for the plant that bears it, but for the future. Its business has to do entirely with the bearing of the seeds from which future plants will spring.

The flower is the part of the plant which is made specially or specialized, as we say, for this purpose. Therefore, we should not expect to find chlorophyll in the flower. The proper place for chlorophyll is in that part of the plant

that is concerned with the upkeep and health of the plant in question, not in the part that is given up to the future of the race. If chlorophyll were present in the flowers, it would be very much more difficult for insects to recognize the flowers among the green leaves, and one of the great duties of most flowers is to make themselves conspicuous, in order that the various insects may visit and fertilize them.

There are varieties of chlorophyll which are not so much green as brownish green, or even a rather yellowish green. We find some of these in sea plants, such as sea-weed, but there is no such thing anywhere as a red variety of chlorophyll.

WHY DOES A POTATO NOT ROT UNDER THE EARTH WHILE IT IS GROWING?

If certain kinds of low vegetable life are present in the soil they may attack even the living potato and rot it; the consequences may be terrible if a whole population largely depends on the potato for food. But usually the potato is protected by two things.

One is its skin, which exists in the case of the potato, as it does in many other vegetables and fruits, chiefly in order to keep out microbes and other things that would otherwise feed upon it and rot it. The other thing is the life in the living cells which make the potato, and especially those cells which lie on the outside of it and are the best part of its food-value, which is commonly lost when we pare potatoes before we cook them. These cells, so long as they are alive, have the power, as every living cell has in some measure, of protecting themselves from most dangerous things, such as microbes or insects.

When a potato rots it is because some other living things are using it as their food. The rotting of the bodies of animals and plants is not to be thought of as something really bad or horrible. It is simply a chemical change produced by the life of other living creatures: their life benefits as the thing they feed upon suffers. Rotting is really, therefore, a kind of digestion.

SHALL WE EVER BE ABLE TO GET TO ANY OTHER PLANET?

One of the greatest men who ever lived, Charles Darwin, said that the really unwise people were those who thought it specially wise to say that men would never be able to do or to know this thing or that, and the history of knowledge has justified him. But even when we remember what Darwin said, we are still inclined to think that the answer to this question must be "No." Jules Verne wrote a clever and delightful story about some men who were shot inside a huge cannon-ball to the moon; and even that is certainly not a possible thing now. But the moon is only 240,000 miles away, and the solar system would have to change a great deal for our earth to be within even 20,000,000 miles of another planet. Nothing could fire a hollow ball fast enough to go so far, even if the direction could be controlled, and even if people inside it could survive the shock of being fired off.

But let us suppose that men could invent some machine that made power in itself, and could keep on doing so, such as a flying-machine. The first difficulty is that, when it got very high, even if the passengers took air with them to breathe, there would not be enough air for the machine to work against. In a vacuum—a space empty of air—the strongest bird could not soar or sustain itself. You might as well try to swim at the usual level in an *empty* swimming bath.

Now, suppose this difficulty did not exist. Even then there would be another which would be fatal. The passengers would have to travel millions of miles through the cold of space. None of us can imagine how cold that is, and it is certain that only a few minutes of it would freeze any human being to death. Even if they traveled to Mars with the speed of light—and we are sure they never could—they would certainly be dead before they got there.

SHALL WE EVER BE ABLE TO TALK TO ANY OTHER PLANET?

This is a very different question from the last. Of course, we must assume that the other planet, say Mars, has intelligent beings upon it, which is quite likely. If that were so, there is no real reason why we should not communicate with them in some way. Of course, they would have to learn how to understand what we meant; but that would not be nearly so difficult as it sounds. As a matter of fact, in France, a large prize awaits the first person who establishes communication with any planet, and perhaps someone may one day be

able to win that prize. If there are intelligent beings on Mars, they are probably far cleverer than we are, for Mars is a much older world than ours, and there has been more time for these beings to learn and grow wise, if they are there at all. Indeed, perhaps they have been trying to attract our attention for ages, and are wondering when the earth-people will grow wise enough to attend to them. It has been even suggested, though not quite seriously, that the great system of canals on Mars—which is quite big enough for us to "read"—is a huge writing, meant to say something to us.

At any rate, the canals prove that communication between Mars and the earth is by no means an impossibility; and if the people of Mars have telescopes as good as ours, they could certainly read anything we wrote large enough in the Sahara Desert or Siberia.

WILL THE EARTH EVER STOP SPINNING?

We know now, quite well, that nothing stops spinning or moving about unless something stops it. A top would not stop spinning but for the resistance of the air and the surface it spins on. The question is, then, do we know anything going on now, or anything that is likely to happen in the future, which may stop the spinning of the earth? The answer is, that the tides have this effect, though many ages may pass before it is shown; that perhaps the mere presence of the ether in space has some effect of resistance; and that in all probability the earth will, therefore, stop spinning some day or other.

WILL THE SUN EVER COOL DOWN AND HAVE THE SAME TEMPERATURE AS THE EARTH?

Yes, this must happen. Indeed, the cooling down must go farther than that, and the sun, if it is to remain as the sun, must certainly become quite cold all through, which the earth certainly is not yet. This need not happen if the sun were to meet some other star, and by the force of meeting be made hot again; but then, of course, it would not be our sun any longer. Our sun would have disappeared, though the stuff of which it is made would remain.

To make something from nothing is an impossibility. Every moment, without ceasing, the sun is giving out enormous quantities of power in the shape of light, and heat, and other things. If the sun were all the time getting from somewhere else as much power as it is giving out, then, as long as that supply is kept up, it need not cool down. Astronomers have very carefully studied this question. The sun gets a certain amount of power from shooting-stars falling into it; it also gets a certain amount of power from the light of the other stars. This is nothing, however, to the power the sun is spending. It must necessarily, therefore, cool down, and become, we have no doubt, like the countless thousands of cold stars or suns which we know exist in the sky.

CAN CHEMISTRY BUILD UP LIFE?

No, chemistry certainly cannot build up living matter yet, and perhaps it never will be able to do so. But we ought to know how far chemistry can go in this direction. It was long believed that none of the things made by life, such as sugar or alcohol, could possibly be made in any other way.

About a hundred years ago, however, a compound called urea, which is one of those made inside our bodies, was made by a chemist *outside* his body; and now chemistry can build up thousands of compounds which are made by living things, and can build them up from their separate elements. This teaches us that chemistry inside living things cannot be so very different from chemistry outside them. But the compounds of the class of white of egg, usually called proteids, are those which, more than others, distinguish living things; and the chemists are as yet only able to make compounds which are *nearly* proteids, but not quite.

No doubt, chemists will soon be able to make all the compounds that compose living matter, or protoplasm, and then call the mixture protoplasm. But it will be only *dead* protoplasm, we may be very well sure. Living protoplasm is far more than a mixture of proteids and sugar and salts and water. It has an architecture, and is as much more than a mixture of these things as a noble building is more than a heap of bricks. The bricks need a builder to make them into a cathedral, and the compounds that compose living matter need a builder to make them into living protoplasm;

and as that builder is Life, we shall be as far from making life when we can make proteids as we were 100 years ago.

HOW DOES CAMPHOR KEEP MOTHS AWAY?

Camphor, like most other things that have a smell, is what we call *volatile*—that is, it gives itself off into the air in the form of a gas. Like many other volatile things, camphor is an *antiseptic*, a thing that is very bad for the lives of microbes. Now, most things that are poisonous to microbes are poisonous to insects. Indeed, as a rule, a poison to any kind of life is a poison to all kinds of life.

Camphor in large doses would kill a man. The camphor gives itself off into the air around it, and as it is very poisonous to moths, when a moth smells camphor anywhere, it flies away. It is a great advantage when an antiseptic is volatile, and all the most useful antiseptics are volatile. If a thing is not volatile, it can only take effect on anything that actually touches it, and perhaps not even then, unless the thing actually starts to eat it, which is unlikely.

If an antiseptic, such as camphor, is volatile, it flies about in the air everywhere. Of course, as it spreads, the amount of it in the air gets less; and so insects or microbes can get within a certain distance and not suffer; but if they go nearer they would be killed. Everything we put in a drawer to preserve clothes is therefore volatile, and so can protect the whole drawer.

IF OUR SKIN IS WATERPROOF, WHY CAN MOISTURE PENETRATE THROUGH IT?

The skin is truly waterproof, and will let nothing from outside get into it, even if we stay in water for hours at a time. If this were not so, bathing would be a very dangerous business. But the skin is almost everywhere pierced by tiny little tubes that run out through the waterproof layer to the surface, from the true skin that lies underneath it. These tubes carry the sweat which is made by the little glands in the true skin, from which the tubes run. Water could, perhaps, get into these tubes, so that the skin would not be waterproof, if it were not that the sweat is coming out of them. As it does so, it has a forward pressure which forces back anything that might enter. And even if it did enter it could not get far, for it would find itself in an exceedingly tiny blind alley—the inside of the sweat-gland. If we rub into the skin very hard, something, such as cod-liver oil, which the sweat-glands are willing to take into themselves and give to the blood, we can succeed in making it pass in through the skin. Also, by means of electricity, we can make liquid things pass in through the skin. But otherwise it is truly waterproof—in one direction.

It would be a very good thing if men were clever enough to invent waterproof clothing that had the same property as the waterproof clothing with which we are all provided by Nature! The trouble is that our waterproofs are waterproof in *both* directions. They keep the rain out, and that is good; but they keep the sweat in, and that is bad. This is the reason why we soon get so hot and muggy when we happen to be obliged to wear a waterproof on rainy days.

WHY DOES OUR HAIR GIVE US NO PAIN WHEN IT IS CUT?

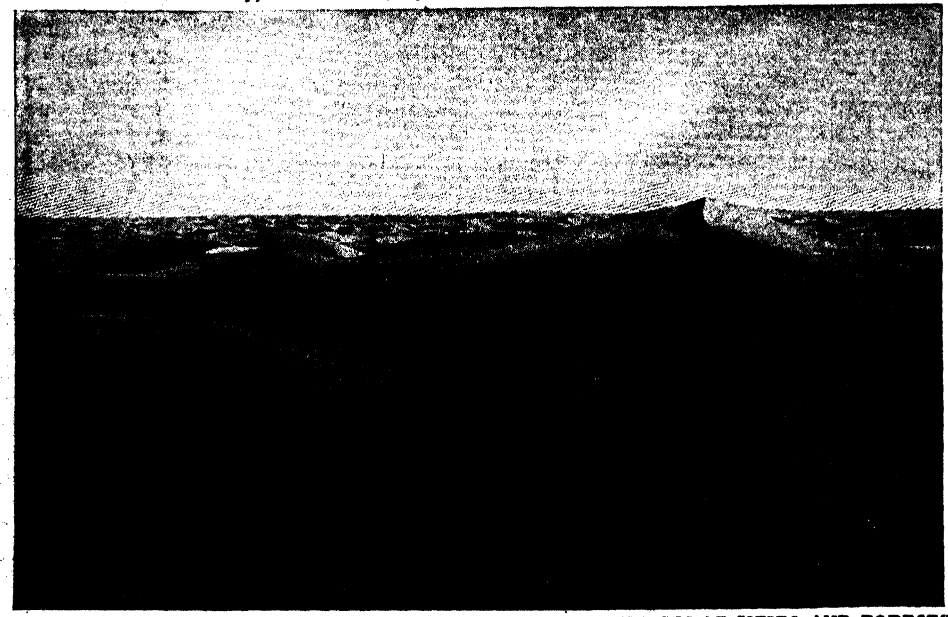
Whenever we feel pain it is because something has disturbed a nerve or nerves that are capable of carrying a message to some part of the brain where there are nerve-cells which can feel pain. If the nerve-cells are out of action because we have chloroform in our blood, we feel no pain. If the nerve has been cut, or has become dead, so that its message cannot be carried, then we feel no pain, even though someone should be cutting off our skin with scissors. And if there are *no nerves* in any part of the body to carry a message, then we cannot feel pain, no matter what is done to that part of the body.

This is the case with hairs. The living root of a hair, where it is made, in the true skin, is supplied with nerves, and so pain is felt if it is disturbed. But no hair in ourselves or in any animal has a nerve in it, and so cutting the hair cannot cause pain. But pulling it does, for that disturbs the hair-root, which has nerves. Nails are much the same as hair, and in the nail itself there are no nerves, so it can be cut without pain. But by far the most curious thing is that the surface of the brain itself has no nerves of the kind that can really feel a touch or a cut; so no pain at all is felt if the brain is touched or cut.

THE NEXT QUESTIONS ARE ON PAGE 4271.

THE WONDER OF A WORLD OF SAND

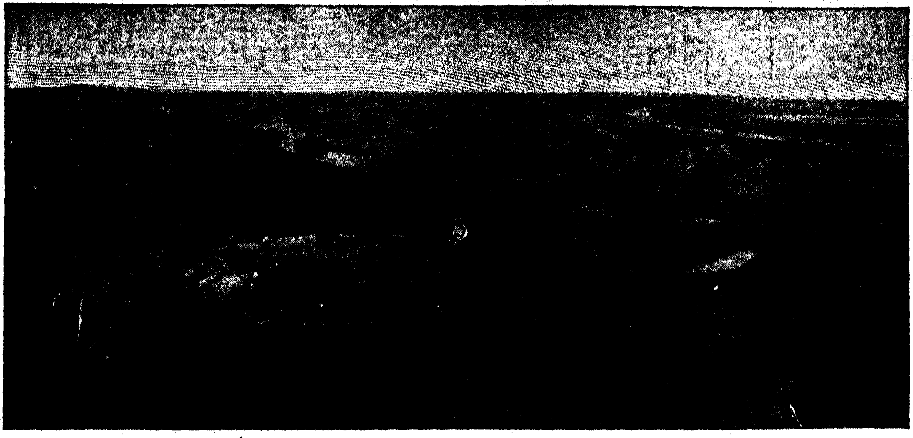
Travelers who have journeyed in the heart of Asia, across trackless deserts of sand that are ever growing wider and wider, have found, deep down under the sand, the ruins of cities, beautiful temples, and extensive forests. Everywhere is evidence that these vast, silent lands were once a flourishing garden, thronged with a prosperous people who traveled, and traded, and manufactured. Great lakes and rivers and a large inland sea watered the country that is now so dry; but an enemy that no man can stand against is ever invading the land, and now the heart of Asia is buried under an ocean of sand, as may be seen in the pictures on these pages. There is one power, and one power only, that brings sound and movement into these dreary, lifeless wastes, says Dr. Sven Hedin, the famous explorer, and that is the wind.



A DESERT OF SAND THAT HAS DRIFTED LIKE SNOW, BURYING GREAT CITIES AND FORESTS

A MOVING HILL OF SAND THAT THREATENS TO COVER A RIVER AND FOREST IN THE DISTANCE

MOUNTAINS BUILT UP BY THE WIND

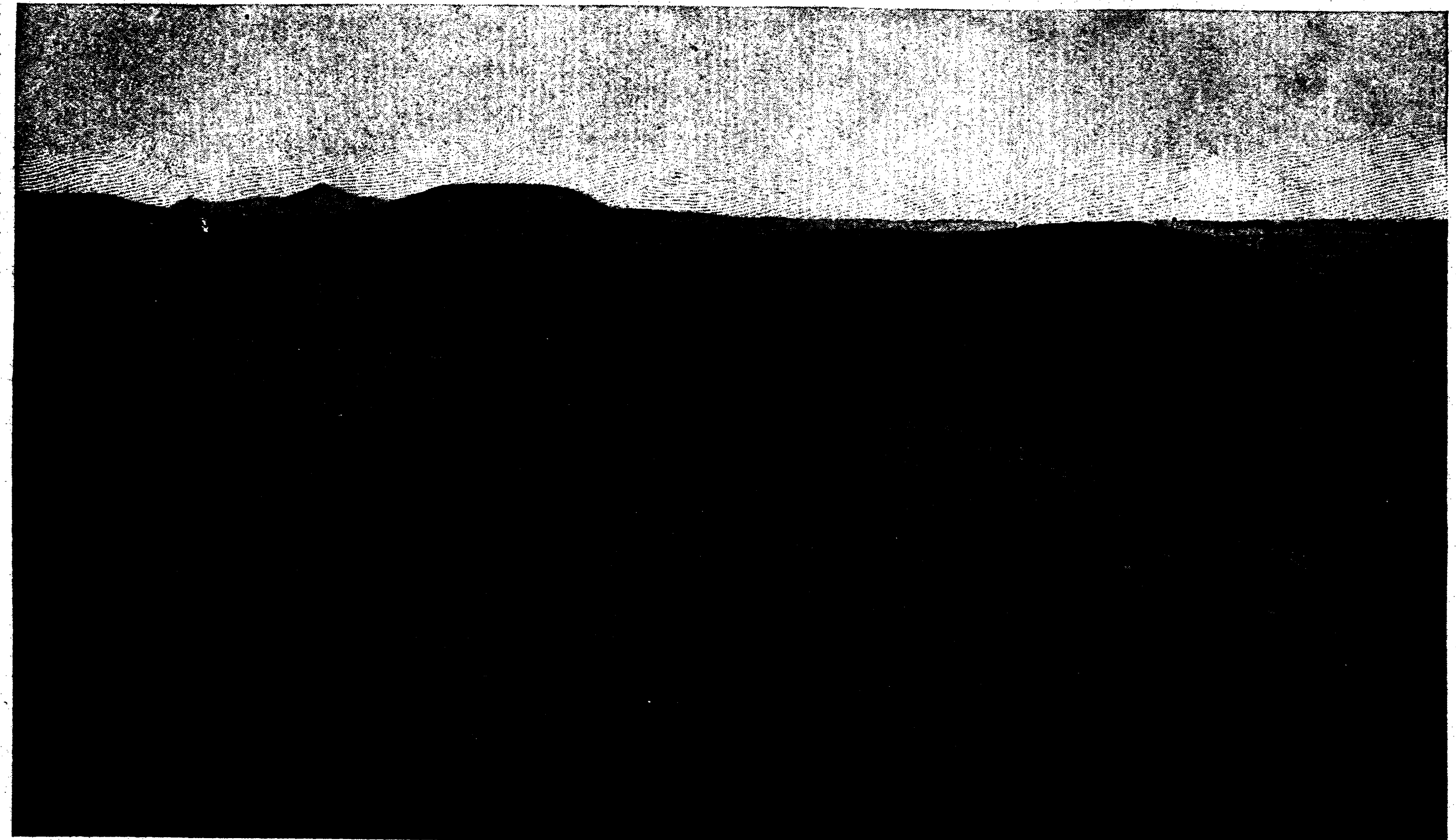


SAND-HILLS NEAR THE TARIM RIVER, SHOWING THE CURIOUS RIPPLE-MARKS MADE BY WIND

THE ENTRANCE TO A GREAT MOUNTAIN PASS THAT IS FAST BEING FILLED WITH SAND

MOUNTAINS OF SAND OVERLOOKING THE TARIM RIVER, BUILT ENTIRELY BY THE WIND

AN EVER-ROLLING OCEAN OF SAND THAT BURIES A CONTINENT



AS THE WIND BLOWS OVER THE DESERT IT CAUSES WAVES OF SAND LIKE THE SNOW-WAVES SHOWN ON PAGE 2534, WHICH GROW INTO DUNES OR HILLS

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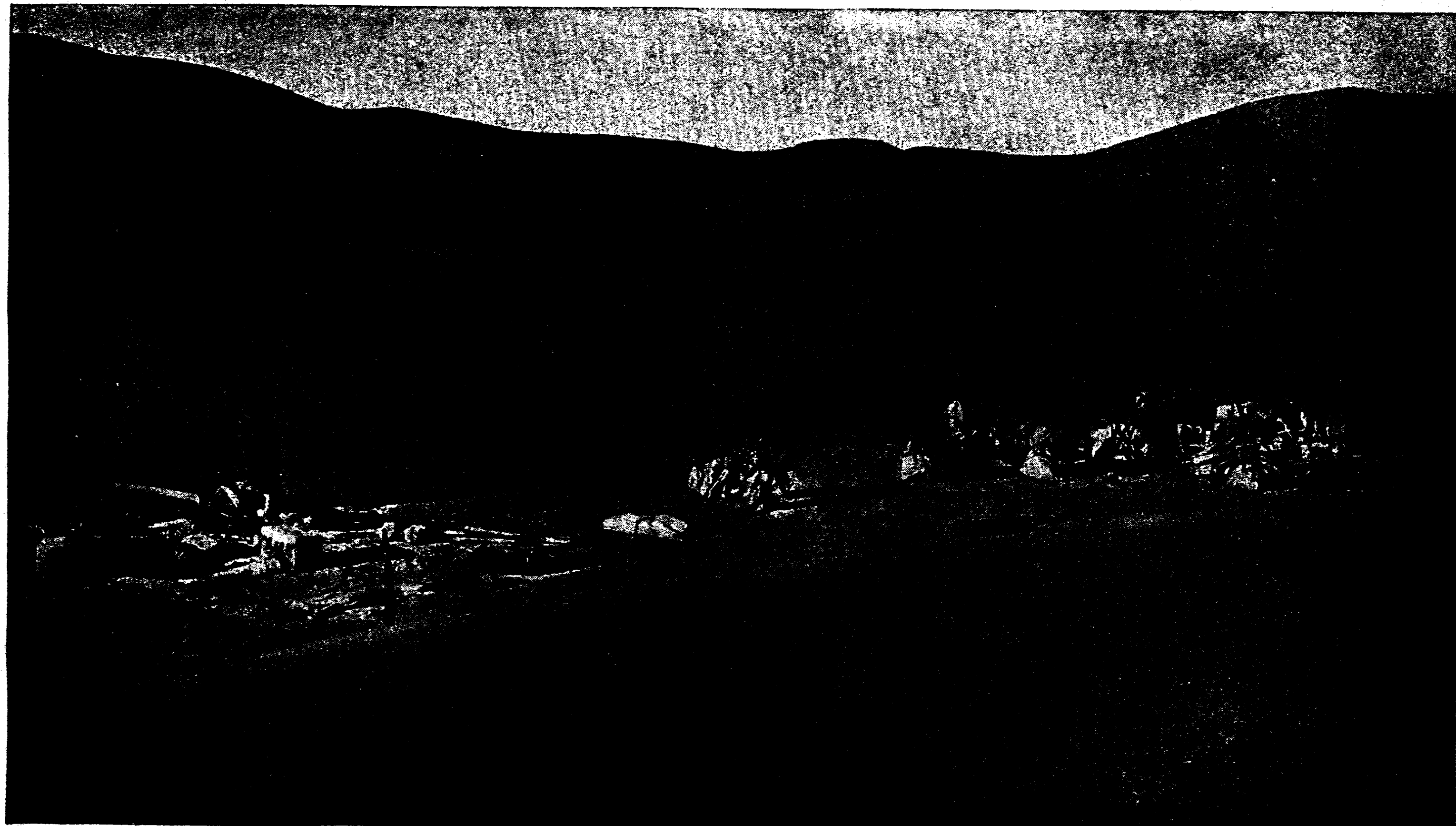
A CAMPING GROUND IN THE DESERT WITH MILES OF SAND ALL ROUND

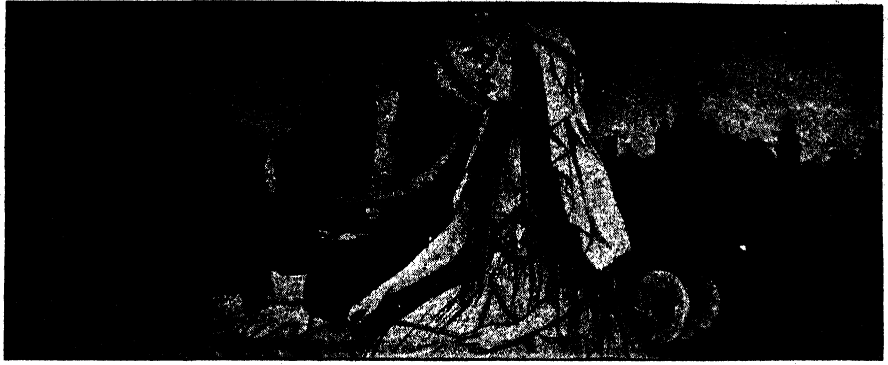


DR. SVEN HEDIN TRAVELED ACROSS THE VAST DESERT OF GOBI, AND DISCOVERED, UNDER THE SAND, THE REMAINS OF RUINED CITIES

THE NEXT BOOK OF WONDER BEGINS ON PAGE 4271.

THE SOLDIER CLIMBED UP THE TREE

"It seems a simple enough matter," said the soldier. "But I should like to know how I am to get down inside the tree." "Fasten this round you, and leave that to me," said the witch, holding out a long rope.



THE MAGIC TINDER-BOX

CONTINUED FROM 4056

TRAMP! Tramp! Tramp!

A handsome young soldier who was returning from the wars, with his knapsack on his back, came upon an old witch standing in the road.

"Good-morning," she said. "It's a fine thing to be rich, isn't it?"

"I don't know," returned the soldier. "I'm so poor that I've not a penny in my pocket."

The old witch came a little nearer.

"Shall I make you rich?" she asked.

The soldier almost dropped his knapsack in his excitement.

"Upon my word," he exclaimed, "I wish you would!"

"Then listen," said the witch. "Do you see that tree yonder? Go near, and you will find a hole in the trunk through which you can let yourself down into a cavern full of treasure. Within are three doors; open one, and you will find yourself in a little room. In the middle stands a chest full of copper coins, and on it sits a dog with eyes as big as teacups. But have no fear; pick him up in your arms and put him on this blue-checked apron which I will lend you, and take all you want.

"If you prefer silver, open the next door you come to, and you will find another little room. In the middle stands a chest full of silver coins, and on it sits a dog with eyes as big as mill-wheels. But have no fear; pick him up in your arms, put him on the apron, and take all the silver you want.

"But perhaps you prefer gold? If so, you must go to the third door. Open it, and you will find yourself in another room. In the middle stands a chest full of gold coins, and on it sits a dog with eyes as big as the Round Tower. But have no fear; pick him up in your arms, put him on the apron, and take all you want."

"I'm sure you're very kind," said the soldier; "but I'll warrant you'll be expecting a nice little pile for yourself!"

"Not a penny," answered the witch. "All I want is my old tinder-box, which my grandmother forgot to bring up with her the last time she was there."

"Well, that seems a simple enough matter," said the soldier. "But I should like to know how I am to get down?"

"Fasten this rope round you, and leave that to me," said the witch.

So the soldier climbed up the tree, and the witch let him down through the hole in the trunk. Down, down, down he went, until he landed safely on the floor of the huge cave, which was ablaze with a thousand lights.

He found a door, opened it, and there, sure enough, on a chest in the

middle of the room, sat the dog with eyes as big as teacups. The soldier lifted the dog on to the blue-checked apron, opened the box, and filled his great pockets with copper coins.

"My word, I'm a lucky man!" he said to himself.

He shut the lid, put the dog back on the box, and went out.

Just then he caught sight of another door. Turning the handle, he went in. In front of him stood a great chest, and on it sat a dog with eyes as big as mill-wheels, just as the witch had said.

He picked up the dog, set him on the blue-checked apron, and opened the chest, which was filled with silver.

"This is worth having," said the soldier, tossing out the copper coins, and refilling his pockets with silver.

When they would hold no more he replaced the dog on the chest, and was turning to go when his eye fell upon a third door, which he opened. In the middle of the room stood a chest, and on it sat a huge dog with eyes as big as the Round Tower. The soldier was terrified, but, remembering what the witch had told him, he summoned all his courage, lifted the dog and set him on the blue-checked apron. Then he flung open the lid, and was amazed at the mass of gold coins that lay there before his eyes.

With both hands he grasped his treasure, and thrust as many coins as would go into his pockets. But they were already so full that many of them fell out about his feet.

"Why should I concern myself with silver when all this gold is mine for the taking?" he thought; and, slipping off his coat, he turned it upside down till all the pockets were empty. Then he refilled them with gold, shut the box, put back the dog with eyes as big as the Round Tower, and made his way to the foot of the tree-trunk.

"Don't forget my tinder-box," called out the old witch from above.

"That's just what I have done," said the soldier, turning back.

He found the box, and was pulled up through the tree.

"What do you want with this old box?" asked the soldier, as he stood once more beside the witch. "It must be very valuable."

The old woman made no reply, but kept her eyes fixed on the box.

"Tell me the secret of the box—for I am sure there is one—or I will certainly cut off your head," said the soldier.

"Give me my tinder-box!" screamed the old woman. "You have gold enough, would you rob me of my box?"

"Yes," replied the soldier brutally; for by this time he was sure that she was a wicked old witch who wished to do harm. Then he picked up his knapsack, and made his way to the nearest town.

Here his money brought him many friends. He lived in a fine house, and had a number of servants to wait upon him. For a long time, indeed, he lived gaily in great style; but at last there came a day when his money was all spent, and he was forced to move into a tiny room in the poor part of the town.

As he was sitting alone one evening in the dark—for he was too poor to afford a light—he suddenly remembered the old tinder-box. He dragged it from where it lay almost forgotten, and opened it, and at the bottom, to his delight, he found a piece of flint. He struck it against the box, but no sooner had the spark appeared than the door of the room flew open, and in burst the dog with eyes as big as teacups.

"What commands has my master for his slave?" said he.

The soldier was amazed.

"My word!" he thought. "Then this must be the secret of the tinder-box. It will evidently bring me whatever I choose to ask for.

"Bring me money," he said aloud, whereupon the creature vanished, and in a few minutes he was back again, holding in his mouth a large bag full of money.

Soon the soldier found out that by striking the flint once the dog that sat on the copper chest came to him; by striking it twice the silver dog appeared, and by striking it three times he could summon the guardian of the gold treasure.

That day there was no happier man in all the town. He returned to his grand house, and once more lived a life of gaiety, and had everything he wished for.

Now, in this town there lived a beautiful Princess. It had been foretold that she would one day marry a common soldier, and this so enraged the King that he locked her up in a great copper

palace, and allowed no one to visit her but himself and the Queen.

When the soldier heard this story he determined to see the beautiful Princess, come what might. So, summoning the dog with eyes as big as teacups, he bade him bring the Princess without delay.

The dog obeyed, and in a short time appeared with her fast asleep on his back. She was so beautiful that the soldier bent over and gently kissed her hand, and then bade the dog take her safely back to the palace.

The next morning the Princess told the Queen that she had had a strange dream. She had dreamed she was riding on a huge dog, and was taken to a soldier who kissed her hand.

"A pretty dream, indeed," thought the Queen. "I'll find out where she goes."

That night she fastened a little bag of flour to the Princess's waist; but before she went away she took out her gold scissors, and made tiny holes in the bag, so that if she moved about the flour would drop out, and mark the road along which she traveled.

This is just what did happen. The soldier had fallen in love with the beautiful Princess, and that night he again sent the dog to bring her to him; and all the way along, as the dog ran from the palace to the soldier's house, the flour dropped out upon the roadway.

The next morning, when the Princess said: "I had that strange dream again last night, I wonder what it can mean," the Queen rose quickly, and went to the window from which she could see the roadway. And there, sure enough, was the little line of white.

Summoning her servants, she bade them follow that white line, and arrest the man to whose house it led; and so, before an hour had passed, the soldier was arrested and cast into prison.

The next day he was to be executed, and as he was sitting in his cell waiting for the guard to come for him, he thought how different things would have been if only he had had time to bring away his tinder-box. Just then his eye fell upon a little shoemaker's apprentice who was passing the window.

"Hi, boy!" he cried, starting up. "Fetch me my tinder-box, and I will give you a gold piece for your trouble."

Away ran the lad in great glee, and soon returned with the magic box. From that moment the soldier knew his troubles were over. But he allowed the soldiers to lead him to the gibbet, and then when the King and Queen and the whole Court were assembled, amid a great crowd of people, to see the execution, just when, in fact, the executioner was on the point of fitting the rope round his neck, the soldier turned to the King, and said:

"Will it please your Majesty that I should smoke one pipe before I die?"

He spoke so courteously that the King consented; and then, in an instant, the soldier drew out the tinder-box. He struck it once, he struck it twice, he struck it three times, and suddenly all three dogs stood before him—the dog with eyes as big as teacups, the dog with eyes as big as mill-wheels, the dog with eyes as big as the Round Tower.

"Protect me! Protect me!" cried the soldier. "Don't let them hang me!"

Up sprang the three dogs, and in an instant there was a wild scene such as had never before been witnessed in that city. The dogs dashed in among the people, scattering them far and wide. The dog with eyes as big as the Round Tower flew at the King and Queen, and tossed them high into the air. They were not much hurt, but they were very much frightened by the great dog.

Then all the people shouted with one voice:

"We will have the soldier for our King. Set him on the throne, and put the gold crown upon his head. He shall marry our Princess, and rule over us."

They flocked to the gibbet and released their hero, while a party of soldiers marched to the copper palace to escort the lovely Princess to the heart of the city, where all the people eagerly awaited her. As the procession came in sight, they burst out into prolonged cheers, so that it was some time before the Lord High Chamberlain could make his voice heard. And when he announced that the Princess had consented to marry the soldier, they clapped their hands, and cheered till the streets echoed.

The next day there was a royal wedding. The soldier married the Princess, and they lived happily together all their lives.

HOW GOTHAM GOT A BAD NAME

EVERYBODY has heard of the Wise Fools of Gotham. But perhaps we do not know who these men were, or where Gotham is, or exactly what is meant by calling them " Wise Fools."

This is the story: Gotham is a village in Nottinghamshire, England, and one day his Majesty King John, marching towards the town of Nottingham, commanded that his retinue should pass through Gotham meadow. Now, it was popularly thought that any land over which the King passed became ever after a public road; so the men of Gotham, who valued their meadow, took steps to prevent King John from crossing that way. The King, angered by their proceedings, sent his officers to conduct an inquiry in the village.

When the officers arrived, they found some of the men shouting and making a tremendous din over a pond. These noisy fellows had an eel on a string, and were trying, so they said, *to drown it in the pond*! Others were found rolling cheeses down the road—giving them a push and letting them bowl along of their own accord. They were sending their cheeses, they said, to Nottingham Market. Others, in a tremendous hurry, were dragging carts and wagons up a hill. They were going to shade a wood, they said, from the hot rays of the sun. And others were building a hedge round a bush on which a cuckoo had settled, to prevent the bird from flying away.

The officers went away half amused and half disgusted, and reported that Gotham was a village of fools utterly beneath the King's notice.

But others, who knew more of the story, said that there were some very wise fools in Gotham, and so the phrase came to signify folly which was put on for a wise purpose. It was really a compliment to Gotham, not a sneer. A charming old English writer, named Thomas Fuller, says: " Gotham doth breed as *wise* people as any which causelessly laugh at the simplicity."

LA JEUNE FÉE DU LAC VAN

THE ENGLISH VERSION OF THIS STORY IS GIVEN ON PAGE 2316.

UN jeune berger de Mothvey gardait ses moutons, une après-midi, près du Lac Van, dans les Montagnes Noires du Pays de Galles, quand trois jeunes fées sortirent de l'eau et se mirent à jouer sur l'herbe. Toutes trois étaient belles d'une beauté surhumaine, mais la plus jeune était la plus adorable; et le berger tomba éperdûment amoureux d'elle et réussit à la faire consentir à devenir sa femme. Le jour du mariage, la fée sortit du Lac Van apportant, en fait de dot, trois vaches, deux bœufs et un taureau, et la noce fut joyeusement célébrée à l'église de Mothvey.

" Et maintenant," dit la fée à son mari, " rappelez-vous que si vous me frappez trois fois sans raison, je serai obligée de retourner au Lac Van."

Le berger dit que jamais il ne ferait chose pareille, et ils vécurent heureux ensemble et eurent trois fils. Mais quand le berger pria sa femme d'aller chercher un cheval pour se rendre au baptême, elle oublia de le faire, et, sans penser à sa menace, son mari lui frappa l'épaule en lui disant de faire ce qu'il lui avait demandé.

" Une fois," dit la fée.

Bientôt après, ils allèrent à une noce et au lieu de s'amuser, la fée pleura tout le temps, comme si elle avait été à un enterrement, et tout le monde était attristé.

" Pourquoi pleurez-vous ? " dit le berger en la frappant sur l'épaule.

" Parce que le mariage ne sera pas heureux," répondit-elle. " Et faites attention! Vous m'avez frappée deux fois déjà."

Le berger devint très prudent car il tenait à ne pas perdre sa femme, mais plus tard, à un enterrement, elle scandalisa tout le monde, en riant et en dansant. S'oubliant complètement, le berger la frappa en disant:

" Est-ce le moment de s'égayer ? "

" Oui," dit-elle. " L'enfant a échappé aux douleurs de ce monde et est entré dans le Royaume des Cieux. Mais vous m'avez frappée trois fois. Adieu ! "

Quand elle pénétra dans le Lac Van, ses bestiaux l'y suivirent. Cependant, quand ses trois fils furent grands, la fée réapparut et leur donna le pouvoir de guérir et ils devinrent tous trois de célèbres médecins.

THE NEXT STORIES ARE ON PAGE 4235.

WHAT THIS ARTICLE TELLS US

ONE of the purposes of our book is to help boys and girls to understand what they read in newspapers or magazines. Every day something is printed about "strikes," "lockouts" or "Labor Unions," and this often puzzles young people. This article tells what these words mean and much besides. No matter what we think about the different organizations of working men, we must know why they have been formed and what they do, if we are to be intelligent citizens. We find that Canada has a better plan of dealing with some of the disputes between employers and their men than most other countries have. As a result the country has not so many strikes.

CANADIAN LABOR UNIONS

CONTINUED FROM 3958

AS you may not know the objects of Trade Unions, I shall try to tell you before saying anything about Canadian Trade Unions in particular. Most people who are members of Trade Unions belong to the so-called working classes, and by this is meant that they work with their hands. These people are generally not very well off, and, as a rule, have saved little or no money. On the other hand, their employers are generally men of means. The result is that a working man is at a disadvantage in making a bargain to work for an employer.

The employers do not care much whether a particular person works for them or not, but it may be a matter of food, clothes and shelter for the working man. It may happen, therefore, that a man will make a very bad bargain with the employer rather than go without work. Then, too, it may be very hard for the working man to be dismissed at any time, and for any reason. The employer usually can get along for a time even if no work is done in his factory, but the men and their families may suffer very much under such conditions.

"In union there is strength" is an old proverb. By adding a letter to one word we have: "In Unions there is strength." The men, especially those in the skilled trades, group themselves in Unions, and make bargains with the employers as Unions. By so doing they increase their power very much and make better bargains. They pay dues to the Unions, partly to meet expenses and partly to provide a fund from which they may draw when they are out of work or ill.

THE TRADE UNION—WHAT IT IS

A Trade Union is composed of a number of men, all of whom work at the same trade. For instance, we have the Brick Layers' and Masons' Union in a particular place. If the place is a large one, there may be several Brick Layers' and Masons' Unions, and all of them may meet at times under the name of a District Council. There are 1,883 Trade Unions in Canada, having 143,343 members. There are very few District Councils, for it is not usual to have them. You will see accounts of Trade Unions in the newspapers almost every day.

THE TRADE AND LABOR COUNCIL

Each of the Trade Unions in the large cities of Canada sends a delegate or several delegates to the Trade and Labor Council of that city. In Montreal, for instance, the Trade and Labor Council is made up of men from the different Unions in the city, and so you will find in the Council men of many different occupations. In the Council meetings, which are frequently held, matters of interest to the working people of the particular city are

discussed. In Canada there are forty-three Trade and Labor Councils.

CANADIAN AND AMERICAN UNIONS

Most members of the Canadian Unions are on friendly terms with the members of American Unions. In fact, Canadians and Americans often belong to the same body, which may have members all over North America. This is true of the Brotherhood of Locomotive Engineers, a very powerful and respected order, about which I shall have something more to say later.

On the other hand, some Canadian Unions will have nothing to do with the Americans. Some think that this is a great mistake, because large bodies of men are nearly always more powerful than smaller bodies are, but other people think that it is a mistake for the people of the two countries to combine. The employers are generally opposed to the combined American and Canadian orders, because it gives the men greater strength in bargaining. Of the 143,343 members of Canadian Unions, 114,722 are in favor of close relations with the American Unions.

THE DOMINION TRADE AND LABOR CONGRESS

This is the name of a body of men made up of delegates from most of the Unions or Councils which have friendly relations with American Unions. It meets every year in a centrally situated city, and the delegates come from all parts of Canada. There are some orders which are friendly to the American Unions, but do not send delegates to the Trade and Labor Congress, and the most important of these orders are the Railway Brotherhoods. The Trade Unions connected with the Trade and Labor Congress have a membership of over 70,000.

THE CANADIAN FEDERATION OF LABOR

The Canadian Federation of Labor is very much like the Dominion Trade and Labor Congress, in being composed of delegates from different parts of Canada, but it is not friendly to a system of close connection with the American Unions, and, as a matter of fact, has nothing to do with them. This policy is the only reason for the existence of the Canadian Federation of Labor. It meets once a year like its rival, but it is not so powerful, as its membership is quite small. The members of the Trade Unions connected with it number about 7,000.

OTHER CANADIAN NATIONAL BODIES

There are ten other national bodies in Canada, but they are very much smaller than the two which I have told you about, and there is nothing of importance to be said about them.

THE RAILWAY BROTHERHOODS

The Canadian Brotherhoods of Railwaymen are all connected with similar Brotherhoods in the United States, with whom they are on the best of terms. Most of them do not send delegates to the Dominion Trade and Labor Congress, but this is not because they are not friendly to the Congress. On the contrary, they are on very good terms with it. But the Brotherhoods have a good deal of money, are very powerful and prefer to stand alone.

They are well able to fight their own battles, as they are composed of very intelligent and competent men, and do not care to be mixed up in the squabbles of others. You may be interested in the names of some of these Brotherhoods, and I shall give them to you. They are the Order of Railway Conductors, the Brotherhood of Locomotive Engineers, the Brotherhood of Firemen and Enginemen, and the Brotherhood of Railroad Trainmen. There are other orders among railwaymen, and some of them send delegates to the Trade and Labor Congress, while one or two are represented in the Federation of Labor, but none of them is so important as those I have named.

STRIKES AND LOCK-OUTS AND WHAT THEY MEAN

When the members of a Union have a quarrel with their employer, and cannot come to an agreement with him, their strongest weapon, and the last to be used, is the "strike." When a strike is ordered, the men cease to work in a body, and try to prevent others from working for their old employer. On the other hand, the employer, who cannot agree with his men, may dismiss them, or a large part of them, and this is called a "lock-out." Now we all know that strikes are not pleasant, but they are about the only means by which Unions can enforce their demands, which may sometimes be very just.

THE INDUSTRIAL DISPUTES INVESTIGATION ACT

In Canada, we have to a certain extent met this difficulty by making it hard for a strike or lock-out to take place in a few important industries called Public Utility Industries. These Public Utility Industries in Canada include steam and electric railways, telephones, telegraphs, mines and a few others. When the men and their employers in these industries have a dispute, it is not legal to call a strike or order a lock-out until an investigation takes place. The Act of Parliament, which makes this necessary, is called the Industrial Disputes Investigation Act or the Lemieux Act.

MOUNT WAPTA AND YOHO VALLEY FROM THE KICKING HORSE PASS

Photograph by Notman, Montreal.

The views of the mountains on both sides of the Kicking Horse Pass are wild and beautiful. Mount Wapta is 9,990 feet high and affords a stiff ascent for those who love mountain climbing, though it is not so dangerous as some others. The Yoho Valley has been made a national park in order that its beauty may be preserved. The Kicking Horse Pass was discovered in 1859 by Sir James Hector.

In order that an investigation may be made, a written statement, setting out the causes of the trouble between the employers and the men, must be sent to the government. So that each side to the dispute may know exactly what is complained of, a copy of the statement must also be sent to the other side.

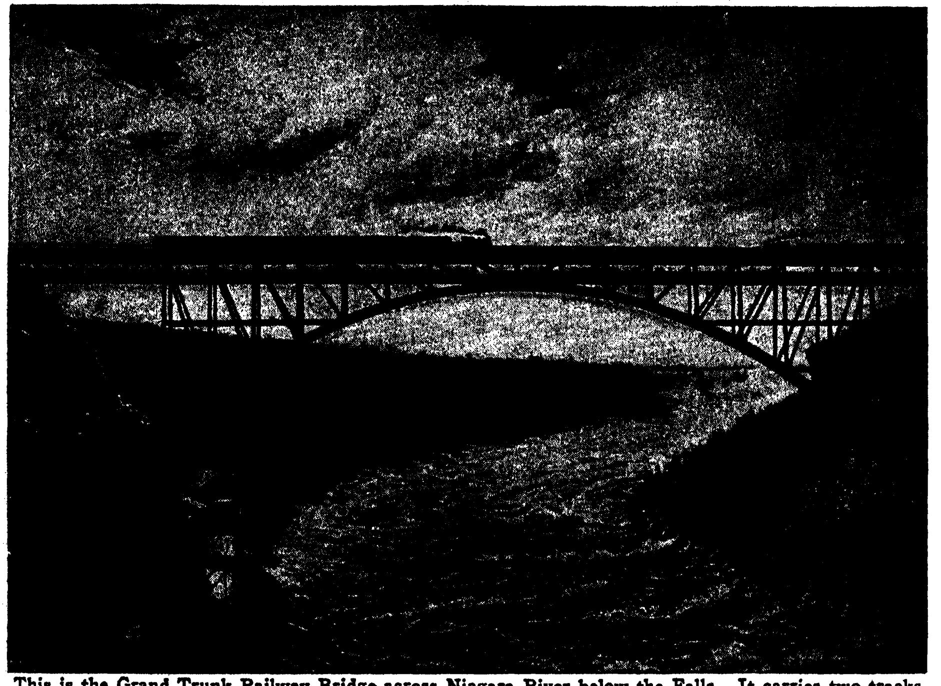
The difficulty to be settled is referred to a Board of three men, one of whom is named by members of the Union, one by the employer and the third by the two already chosen. This third man, who is generally a judge or lawyer, is the chairman. The members of the Board listen to both sides of the question, and give their decision, and not until this decision is given may a strike or lock-out be declared.

Neither the employers nor the men are compelled to accept the decision of the Board, but a strike or lock-out is seldom successful when the public are not in favor of it, and, as the public will generally agree with the members of the Board, the employers and men will act very foolishly if they do not accept its decision.

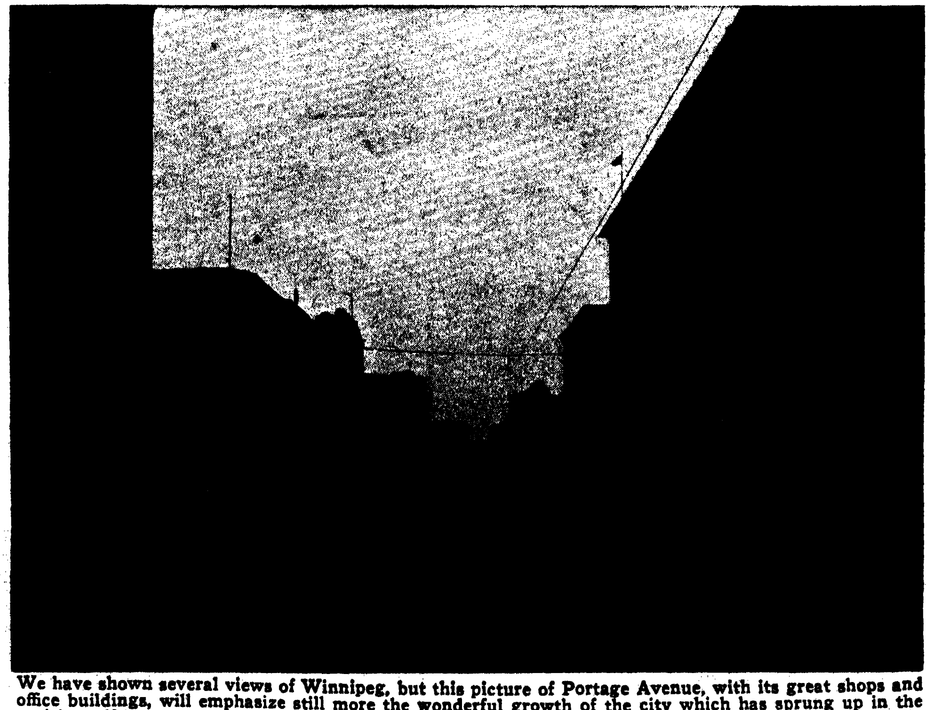
This act has been very successful. In most cases, a strike or lock-out has not been declared at all, but both sides have accepted the judgment of the Board, and even in those few instances where a strike or lock-out has followed, the final agreement has generally been precisely that which the Board had advised.

THE NEXT STORY OF CANADA IS ON PAGE 4323.

HERE AND THERE IN CANADA



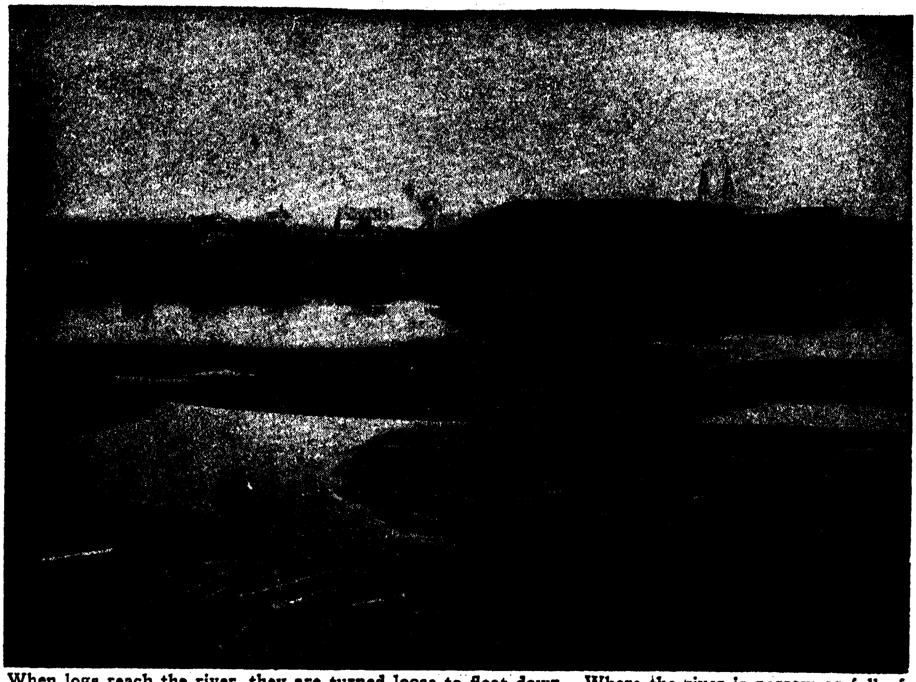
This is the Grand Trunk Railway Bridge across Niagara River below the Falls. It carries two tracks for trains, and below are roadways for vehicles and for passengers. The bridge is 1,100 feet long and is 226 feet above the water. Notice the electric railway line along the side of the river. You can see the Falls far up the river. An electric railway runs along the heights on the other side of the river.



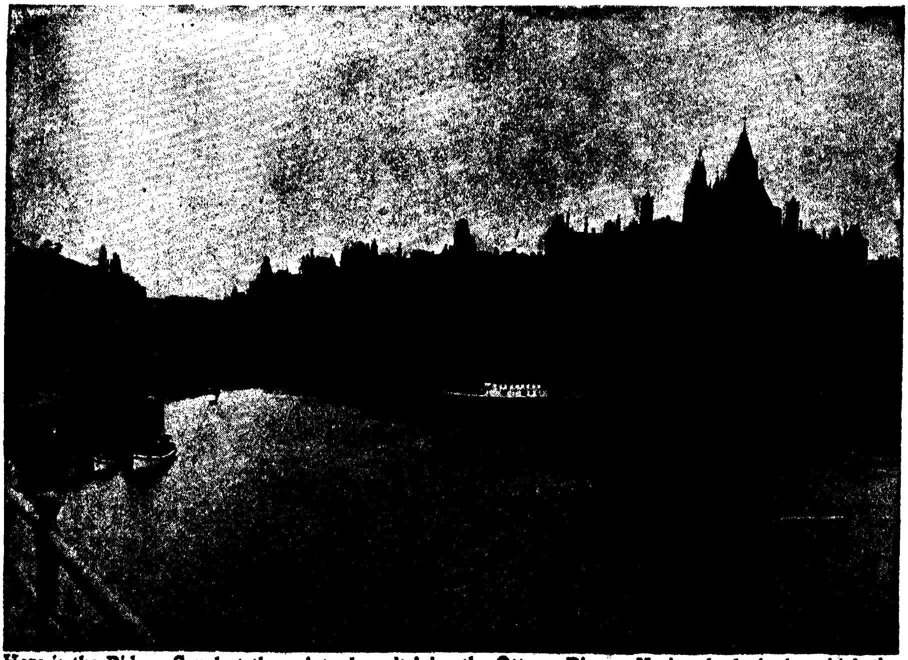
We have shown several views of Winnipeg, but this picture of Portage Avenue, with its great shops and office buildings, will emphasize still more the wonderful growth of the city which has sprung up in the prairie as if by magic. It is difficult to realize that in 1870 there were only 240 inhabitants in the little village. With the coming of the railroads, population increased rapidly and the city is now large and prosperous.

Pictures by courtesy of the Grand Trunk Railway.

ALONG THE OTTAWA RIVER



When logs reach the river, they are turned loose to float down. Where the river is narrow or full of projecting rocks, the logs sometimes "jam," that is, form a sort of dam, and it is both difficult and dangerous to start them again. These logs have floated to safety and lie in the smooth water of the Ottawa River. They are kept together by other logs chained together forming "booms."



Here is the Rideau Canal at the point where it joins the Ottawa River. Notice the locks by which the boats are raised to the higher level, or descend from it. The Library of Parliament and the rear of the Parliament Buildings are shown on the bluff at the right. By means of the Rideau Canal, River and Lakes navigation is open between Ottawa and Kingston, and thence of course into Lake Ontario.

Photographs by Notman, Montreal.

PLANT RELATIONS AND PLANT STRANGERS

Few who have not studied plants would think that the common white clover, or Dutch clover, seen here, belongs to the same family of plants as the pea.

European furze, which seems so unlike both clover and pea, is a member of the same family. Nearly 7,000 different plants belong to the Pea Family.

The European daisy represents the largest of all the families of plants. There are ten thousand different plants belonging to this Composite Family, which includes the thistles, chicory, and dandelion.

This is wild cabbage, that grows on cliffs in Europe. It represents the Cabbage Family, to which belong mustard, horse-radish, various cresses, woad, that gave the blue dye to the ancient Britons, and radish.

There appears to be little likeness between these flowers, and yet they belong to the same family as the rose. On the left is Alpine lady's mantle, in the middle wild cherry, and on the right stone bramble.

THE FAMILIES OF PLANTS

CONTINUED FROM 4016

ONE of the chief troubles that confront us when we seek to learn to know the flowers is the very great number of distinct kinds that grow even in our own country. In America alone there are over 4,600 different wild flowers, shrubs, and trees; but if we extend our study all over the world, we shall find that there are over 100,000. When we find a flower in the woods or fields and want to know its name, how is it possible to pick it out of a list of 4,600? It is not an easy matter at first, but many men, called botanists, have, by their labors, made the task much less difficult than it seems to us.

They discovered first that many plants, which differ widely in size and habit, in the shape of their leaves and in the color of their flowers, agree in the arrangement of the parts of their flowers and the structure of their fruit.

These resemblances they regard as family likenesses, and by means of them they are able to arrange all these thousands of plants into small groups. Now, instead of hunting blindly through the descriptions of *all* the flowers, we have only to find by its structure to which family it belongs, and then to search through that family for the one that is most like the flower we have found.

In the Story of Animal Life, we learn that animals fall into similar groups. If, in walking through the streets, we meet with a fox terrier, an Irish terrier, a poodle, a mastiff, or a staghound, we know the type of structure so well that we could tell anyone that they are all dogs. And if we go to a zoo, and see a wolf there, we know at once that it belongs to the same family. So, too, with our knowledge of cats—tabbies, black, white Persians, and so on. When we see a lion or a tiger, we know that it is a cat of some kind—that is, one of the cat family. The same rule applies to all living things, whether animals or plants, and the discovery of these family relationships has simplified matters.

One of the first things we ought to do is to get a general idea of the chief characters that mark these families. We may, perhaps, know that our 2,000 wild flowers are divided up into nearly a hundred families, and it will be a pleasant pastime to pick out the flowers of different families in our walks.

Every boy and girl knows the beautiful wild rose, or dog-rose, that covers

many hedges with its pink or white flowers in June. Each flower consists of a green ball about the size of a pea, from the top of which spread five ragged green leaves. Above these are the widely spread, broad petals of a delicate pink or white tint, which are also five in number. Spreading over the narrow ends of these petals is a ring of green pins with yellow heads, and right in the centre of this ring is a cluster of hairy threads of a greenish color.

The green ball is called the *receptacle,* and inside it are the *carpels* which contain the seed-eggs. After the flower has fallen to pieces, the receptacle will grow into the red egg-shaped "hip" that makes a fine show on the hedgerows in the autumn. The ragged green leaves are the *sepals,* the five forming the calyx. The five petals, as a whole, are spoken of as the *corolla.* The yellow-headed pins are the *stamens,* and the hairy threads are the *pistils.*

THE ROSE FAMILY

Now, if we were to take a flower from an apple-tree, a plum-tree, a cherry-tree, a may-tree, a blackthorn, a bramble, a mountain-ash, a strawberry, and a meadow-sweet, we should find that, in spite of small differences, they are all constructed on the same plan. Between the plants that bear these flowers there is little resemblance. Some are trees, some shrubs, some lowly herbs; but, owing to their flowers being of the same type, they are all included in the great Rose Family.

There are several branches of the family, known by differences in their fruit. The apple, pear, mountain-ash, and white-beam have several tough-skinned seeds, that we call pips, in a horny core, composed of five carpels, or seed-vessels, which is surrounded by firm, juicy flesh. The cherry, plum, and blackthorn have only one large seed in a bony stone, covered with sweet, juicy pulp. In the strawberry, the receptacle itself becomes pulpy, and bears the seeds upon its surface; the bramble and raspberry wrap each seed in a separate globe of juice. Some of the rose family, like the cinquefoil, silverweed, and agrimony, have yellow flowers, and some of them are passed by as buttercups, because of their color; but if they are compared with buttercups they will be found to be quite unlike them. Here, then, among these well-known plants, flowers, and herbs, we may get a good idea of what is meant by a plant family.

THE POPPY FAMILY

The Poppy Family is a small one, and its members may easily be detected. Its flowers are always of regular shape, and have only two sepals and four petals. The sepals drop off when the crumpled petals burst out and smooth themselves. The slender stamens are very many, but they all drop with the petals as soon as the seed-eggs in the big pistil are fertilized. In the true poppies, the pistil is a rounded or club-shaped knob with a sloping roof, on which the lines running from the centre to the edges are the stigmas. In the greater celandine and the horned poppy, the pistil is more slender, and lengthens greatly after the petals have been shed. In the horned poppy, which we may meet with at the seaside, it grows into a curved seed-vessel a foot long. The seed-vessel of the true poppies we all know as a poppy-head.

THE BUTTERCUP FAMILY

The Buttercup Family includes not only plants with an open cup-shaped flower, such as everybody knows a buttercup to be, but also such strange shapes as those of the larkspur and the columbine. They have five sepals, five petals, many stamens, and many pistils, as a rule. Each pistil ends in a little point.

THE CROSS-BEARER FAMILY

The cabbage, cress, stock, mustard, radish, turnip, and a host of field and wayside weeds make up the large family of Cross-bearers—so called because their four sepals and four petals are always placed crosswise. If we look at a flower of stock or wallflower, we shall see what is meant; then we shall always be able to tell one of this numerous family when we meet with it.

There are only six stamens—sometimes fewer—of which two are smaller than the others, and there is only one pistil, which grows into a long, slender pod, which usually splits down the sides to set free the one or two rows of seeds. Over sixty of the wild flowers found in this country belong to this family. With few exceptions, they are not very showy, and therefore are called weeds.

THE VIOLET FAMILY

The Violet Family is quite easily recognized, since its flowers are what are termed irregular, because its petals are not all of the same size or shape. There are five sepals, five petals, five stamens, and one pistil. The violet and the pansy are well known, so we can easily follow the description. One of the petals is larger than the others; this is really the upper petal, but, owing to the fact that the flower-stem always curves over, it appears to be the lowest petal. This petal is continued behind as a spur, or hollow tail, and in it the nectar is produced for the attraction of insects. Two of the five stamens have tails also, which extend back into this spur, and all of them end in flat points, which fit closely around the bent pistil. The stigma is simply a hollow ball.

THE PINK FAMILY

A larger family is that of the Pinks, which will be familiar to us through the pinks, carnations, and sweet-william of the garden. But we have many wild flowers also that belong to this family, among them campion, catchfly, corncockle, stitchwort, and chickweed. They all have their leaves in pairs, and often the lower ends of a pair are joined together around the stem. The flowers are always regular, the sepals and petals four or five in number, the stamens twice the number of the petals, and the pistil ending in two to five stigmas. In the pinks and campions the sepals are all joined together to form a stiff tubular calyx; in the chickweed and stitchworts they are separate. The seed-vessel is either long and cylindrical, splitting at the top into several teeth, or short and round.

THE ST. JOHN'S-WORT FAMILY

We probably know the large, yellow-flowered rose of Sharon that is often grown in gardens, though it is wild in some places. It is a member of the St. John's-wort Family, of which we have a dozen varieties among our wild flowers. They are mostly very upright-growing plants, with slender stems and smooth, oval opposite leaves. The flowers are yellow, with five sepals, five petals, a great number of stamens arranged in separate bundles, and a pistil that ends in three or five stigmas. Some of the plants, if we hold them up to the light, will be seen to have clear little dots on the leaves, as though they had been pierced through with pins; and some have raised black dots and lines along the edges of the leaves, sepals, or petals. The marsh St. John's-wort, that grows in wet places, has trailing stems and rounder, soft, hairy leaves.

THE GERANIUM FAMILY

The Geranium Family, though it includes the large and showy geraniums of the garden and greenhouse, is, so far as our wild plants are concerned, a family with small flowers as a rule. But they are all very pretty, not only in their flowers, but in their leaves also. With the exception of the yellow balsam, or touch-me-not, they all have quite regular flowers. The herb-robert, that grows commonly on wet rocks, and the wood-sorrel, that is abundant in spring in old woods, are among the best known of this family. There are five sepals, five petals, usually ten stamens, and the pistil ends in a stout style, which branches at the top into five stigmas. The plants with regular flowers have five streaks upon their petals pointing the way to the glands where the nectar is poured out. All of them have peculiar seed-vessels, so contrived that, when ripe, the seeds are shot off to a great distance from the mother-plant.

THE PEA FAMILY

The Pea Family is a very large one, and includes furze, broom, the vetches, medicks, and clovers. Most of them have the leaves divided into three or more leaflets, and the flowers are always irregular and of peculiar form. The five sepals are joined together. Of the five petals, one—known as the standard—is very much larger than the others, two others are known as wings, and the two smallest form the keel.

The last two often have their edges joined together, and between them will be found the ten stamens, and the long, curved pistil, whose thickened portion—the *ovary*—grows into the long pod we know so well in the case of the green pea. These pods are not always as straight as they are in the pea, the bean, and the furze. In the clovers it is short, in some of the medicks it is shaped like

a reaping-hook, in others coiled on itself like a snail-shell. In this family are included all the clovers and vetches, rest-harrow, and beans.

THE SAXIFRAGE FAMILY

Another large family, of which several members are well known to us, is the Saxifrage Family. They have small flowers as a rule, but these are always very pretty. The four or five sepals are joined together, forming a tube-shaped calyx, from which the five petals emerge. There are five to ten stamens, and an ovary with two to four stigmas.

The saxifrages proper are neat little plants, mostly growing on mountain-sides, of which the London pride of our gardens is the best known. This is a wild plant in the west of Ireland.

In the golden saxifrages, that grow along streams and in marshes, the flowers are small and have no petals; but the sepals and leaves adjoining, being bright yellow, make the plants conspicuous.

The grass of Parnassus has a single large white flower. Between its five stamens are five broad scales fringed with knobbed hairs. The currant and gooseberry belong to this family. In the copses of the North we may find red and black currants, and the gooseberry.

THE PARSLEY FAMILY

One of the largest of our plant families is the Parsley Family; and in almost every case when we meet with one of these plants we may know at once to which family it belongs. The flowers are very small, but they are many and are arranged on slender stalks that radiate from the top of a thicker stalk.

If the wind blew our umbrella inside out, and we stripped off the covering, the framework would look just like the flowering stem of one of this family—the stick being the stout stem and the ribs the slender flower-stalks.

In most cases we need a magnifying-glass to make out the structure of the flowers clearly. There is a very simple calyx, sometimes having fine teeth along its rim, to show that it is composed of five united sepals. There are five very tiny heart-shaped petals of white or yellow—bluish in sea-holly—five curved stamens, and a quaint pistil with two stigmas. Some of the plants—such as hemlock and cowbane—are very poisonous; others, such as carrot, parsnip, celery, parsley, samphire, and caraway, are most useful as food or for flavoring

THE COMPOSITE FAMILY

Largest of all these families is the daisy family, known as the Composite Family, because a great number of tiny, stalkless flowers are packed together to form what is known as a flower-head. What we call a daisy flower is a bunch of about 250 flowers, or florets, of two forms, the outer row with a white strap-shaped corolla, and the inner one with yellow tube-like corollas. If we cut a daisy right through the middle we can see that this is so, and will understand why the family is called composite, or compound flowers. But all composite flowers are not exactly like the daisy; some, like the dandelion, the tansy, and the thistle, have only tubular corollas.

In addition to the flowers named, this family includes, besides others, the asters, dog-daisy, wormwood, coltsfoot, groundsel, chicory, lettuce, sow-thistle, and goat's-beard. Among well-known garden composites are the dahlia, chrysanthemum, and sunflower.

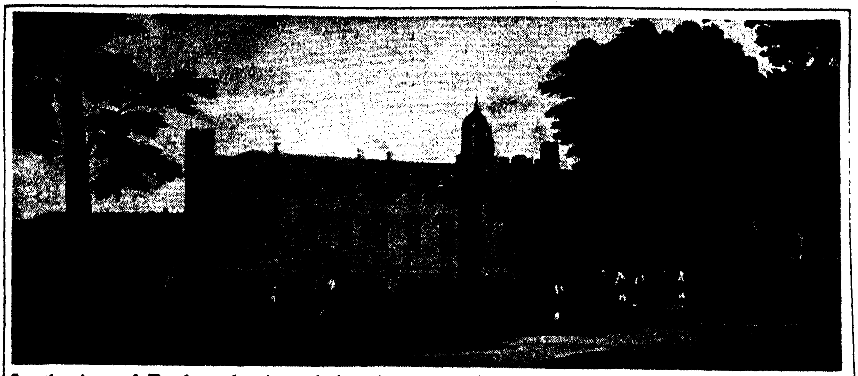
SOME OTHER FAMILIES

There are so many plant families that it is impossible to describe them all. There is the Bellflower Family, of which the harebell, the Canterbury bell, the lobelia, and a campanula are examples; and the Heath Family, including, besides heath and heather, the bilberry, the cranberry, and the strawberry tree.

The Primrose Family has, beside primrose and cowslip, such well-known flowers as creeping jenny and pimpernel. To the Gentian Family belong the beautiful blue flowers that give the family its name; also the yellow-wort, the centaury, and the buckbean. The Borage Family gets its name from the borage, whose flowers have a brilliant blue of their own. Other members of this family are comfrey, bugloss, lungwort, forget-me-not, and hound's-tongue.

Besides these families there are the Nightshade Family, the Figwort Family, the Mint Family, the Orchis Family, the Lily Family, the Daffodil Family, and so on. We shall learn the differences between them as we read about the flowers on other pages.

THE NEXT STORY OF PLANT LIFE IS ON PAGE 4205.



South view of Rugby schools and dormitories as they were in the days of "Tom Brown."

TOM BROWN'S SCHOOLDAYS

THIS is a celebrated story of English school life. It was written in 1856 by Thomas Hughes, an eminent lawyer and judge, but, better still, a good man and a friend and helper of the poor. Judge Hughes was born October 23, 1823, and died March 22, 1896. He was educated first at Rugby, under the famous Dr. Arnold, and afterwards at Oxford. This famous story is largely an account of his and his brother's experiences, and we are not far wrong in reading Thomas Hughes where it says Tom Brown. He also wrote "Tom Brown at Oxford," but that is not quite so delightful a book as its forerunner, perhaps because it is more difficult to interest us in the life of a young man than in the doings of a merry schoolboy.

CONTINUED FROM 4076

IN the royal county of Berks, and in that part of it known as the Vale of White Horse, lived Squire Brown, Justice of the Peace for the county. He was a man of strong democratic opinions, and had no prejudices against his fellow-men less blessed than he with worldly wealth.

The life of the Brown household had always been simple and uneventful, the squire's chief diversions being a visit twice a year to Reading and Abingdon at the time of the assizes or quarter sessions. Tom's mother was a very practical country lady; and, indeed, her thorough-going qualities had earned for her the title of "Madam Brown." Under the guidance of his alert and sensible mother, Tom's character had been shaped in the right direction from his earliest years; while his father believed in letting him mingle with the boys of the village, instead of keeping him aloof from them, as only by mixing with others are the rough edges of our character smoothed down. For this reason the squire provided the village boys with a fine cricket-pitch, and even supplied them with bats and balls. None of the cricketers were more enthusiastic for the game than young Tom Brown; and while this was excellent in its way, it ceased to be so when Tom's devotion to the game led to his inducing his playmates to stay away from school and play cricket. The village schoolmaster had to complain of this to the squire, and perhaps it was in consequence that Tom was sent off to a private school at the age of nine. His departure from the village was the cause of great regret to all the boys, with whom he had been very popular—perhaps in some degree because he had preferred cricket to study.

His life at the private school was by no means a pleasant change to him. For the first time, he found himself subjected to supervision out of school as well as indoors. The two ushers were weak, characterless fellows, who allowed the older boys too much freedom and were over-

strict with the young. Tale-bearing, spying, and all sorts of petty meanness were regular features of the place, much to Tom's disgust. He, however, imbibed a fair amount of Latin and Greek, but in the holidays was constantly wanting the squire to send him to a public school.

Great was his joy, therefore, when in the middle of his third half-year, in October, 183–, fever broke out in the village, and, the master having himself slightly sickened of it, the whole of the boys were sent off at a day's notice to their respective homes. The squire was not so pleased as Master Tom to see that young gentleman's brown, merry face appear at home some two months before the proper time for Christmas holidays; and, thinking what had best be done with him, he decided to send him to the famous school at Rugby, where the headmaster had kindly agreed to let him enter at once for the last six weeks of the term.

Tom's father accompanied him into London to see him off in the Tally-ho coach for Rugby, and gave him, in his own blunt way, some good advice.

TOM BROWN IS TO GO TO RUGBY SCHOOL, AND RECEIVES SOME GOOD ADVICE

"And now, Tom, my boy," said the squire, "remember you are going, at your own earnest request, to be chucked into this great school like a young bear, with all your troubles before you. If schools are what they were in my time, you'll see a great many cruel things done and hear a deal of bad talk. But never fear. You tell the truth, keep a brave and kind heart, and never listen to or say anything you wouldn't have your mother and sister hear, and you'll never feel ashamed to come home or we to see you."

It was three hours before dawn that the Tally-ho left the Peacock Inn at Islington with Tom seated on the top; and a stage-coach journey on a cold November night for a boy of ten was certainly no joke, so that long before Rugby was reached the young passenger on the roof had learned a very useful lesson in endurance.

From the old guard of the Tally-ho Tom heard many tales of life at Rugby and of the pranks played there by the schoolboys. So eager was he to know of the new life into which he was to enter that he plied the guard with question after question, until the old fellow not only brushed up his memory, but drew a little on his imagination, though all he said was accepted by Tom in perfect faith.

"Werry out-o'-the-way place, sir; no paving to streets, nor no lighting," was how he pictured Rugby. "Mazin' big horse and cattle fair in autumn—lasts a week; just over now. Takes town a week to get clean after it. Belong to school, sir?"

WHAT THE OLD GUARD OF THE TALLY-HO TOLD HIS YOUNG PASSENGER

"Yes," said Tom, not unwilling for a moment that the guard should think him an old boy. But then, having some qualms as to the truth of the assertion, and seeing that if he were to assume the character of an old boy, he couldn't go on asking the questions he wanted, added: "That is to say, I'm on my way there. I'm a new boy."

The guard looked as if he knew this quite as well as Tom.

"You're werry late, sir," said the guard; "only six weeks to-day to the end of the half." Tom assented. "We takes up fine loads this day six weeks, and Monday and Tuesday arter. Werry free with their cash is the young gen'lemen. But, bless you, we gets into such rows all 'long the road, what wi' their pea-shooters, and long whips, and hollering, and upsetting everyone as comes by; I'd a sight sooner carry one or two on 'em, sir, as I may be a carryin' of you now, than a coach-load."

"What do they do with the pea-shooters?" inquired Tom.

THE STIRRING STORY OF THE BATTLE OF THE PEA-SHOOTERS

"Do wi' 'em? Why, peppers everyone's faces as we comes near, 'cept the young gals, and breaks windows wi' 'em too, some on 'em shoots so hard. Now, 'twas just here last June, as we was a-driving up the first-day boys, they was mendin' a quarter-mile of road, and there was a lot of Irish chaps, reg'lar roughs, a-breaking stones. As we came up, 'Now, boys,' says young gent on the box—smart young fellow, and despret reckless—'here's fun! Let the Pats have it about the ears.' 'Easy there, sir,' says Bob—that's my mate, the coachman—'don't go for to shoot at 'em, they'll knock us off the coach.' 'Hang

it, coachee,' says young my lord, 'you ain't afraid. Hoora, boys, let 'em have it!' 'Hoora!' sings out the others, and fill their mouths chock full of peas to last the whole line. Bob, seeing as 'twas to come, knocks his hat over his eyes, hollers to his 'osses, and shakes 'em up, and away we goes up to the line on 'em, twenty miles an hour.

"The Pats began to hoora, too, thinking it was a runaway, and first lot on 'em stands grinnin' and wavin' their old hats as we comes abreast on 'em; and then you'd ha' laughed to see how took aback and choking savage they looked, when they gets the peas a-stinging all over 'em. But, bless you, the laugh weren't all on our side, sir, by a long way. We was going so fast, and they was so took aback, that they didn't take what was up till we was half-way up the line. Then 'twas look out all, surely.

"They howls all down the line fit to frighten you, some on 'em runs arter us and tries to clamber up behind, only we hits 'em over the fingers and pulls their hands off; one as had had it very sharp act'ly runs right at the leaders, as though he'd ketch 'em by the heads, only luck'ly for him he misses his tip, and comes over a heap o' stones first.

HOW THE "YOUNG GEN'LEMEN" PAID FOR THE DAMAGE THEY HAD DONE

"The rest picks up stones, and gives it us right away till we gets out of shot, the young gents holding out werry manful with the pea-shooters and such stones as lodged on us, and a pretty many there was, too.

"Then Bob picks hisself up again, and looks at young gent on box werry solemn. Bob'd had a rum 'un in the ribs, which'd like to ha' knocked him off the box, or made him drop the reins. Young gent on box picks hisself up, and so does we all, and looks round to count damage. Box's head cut open and his hat gone; 'nother young gent's hat gone; mine knocked in at the side, and not one on us as wasn't black and blue somewheres or another, most on 'em all over. Two-pound-ten to pay for damage to paint, which they subscribed for there and then, and give Bob and me an extra half-sovereign each; but I wouldn't go down that line again not for twenty half-sovereigns."

After this graphic description the guard shook his head slowly, and got up and blew a clear, brisk toot, toot.

"What fun!" said Tom, who could scarcely contain his pride at this exploit of his future schoolfellows. He longed already for the end of the half-term that he might join them.

Tom had not time to alight from the stage-coach, as it slowed down at Rugby, before one of the boys came running from the school, and, jumping up behind, announced to Tom that his name was East, and his aunt, who lived down in Berkshire, had written to him to look out for young Tom Brown.

TOM ARRIVES AT RUGBY AND FINDS AN UNEXPECTED FRIEND THERE

This was indeed a jolly reception for the lonely traveler, and he and East were chums at once, for the lad was of a frank and friendly disposition, and introduced Tom to all his own particular friends forthwith.

Nothing could exceed the new boy's interest in all the features of the famous school; the study-room, with its sporting pictures, its cricket-bats, fishing-rods, and climbing-irons, seemed to him more interesting than Windsor Castle itself. At the dinner-table he was a little subdued; but to East's tales of the football field and its numerous accidents he listened as to the battle stories of a veteran. In the big room all the scholars now assembled to answer to their names, and it was with a thrill of pleasure Tom made his first response as a public-school boy.

Tom was in luck's way, for this day of his arrival was signalized by the School-house match, in which East counted himself a tremendous hero to be permitted to play on the School-house side.

TOM'S FIRST GREAT FOOTBALL MATCH, AND HOW HE ACQUITTED HIMSELF

It was indeed a great sight for Tom, this first football match on a grand scale in which he was to take his place. For the School-house team of some fifty boys, who were distinguished by white trousers, in which they felt abominably cold that November day, had to meet and do battle with all the rest of the school.

Such excitement Tom had never witnessed. Nothing approaching the scrimmages had he ever imagined, and in this breathless match Tom was to have his share. For the ball rolled slowly in behind the School-house goal,

not three yards in front of a dozen of the biggest School players-up.

There stood the School-house præposter, safest of goalkeepers, and Tom Brown by his side. Now is your time, Tom. The blood of all the Browns was up, and the two rushed in together, and threw themselves on the ball, under the very feet of the advancing column; the præposter on his hands and knees arching his back, and Tom all along on his face. Over them toppled the leaders of the rush, shooting over the back of the præposter, but falling flat on Tom and knocking all the wind out of his small carcase.

OLD BROOKE, THE CAPTAIN, DECLARES TOM IS A PLUCKY YOUNGSTER

"Our ball," said the præposter, rising with his prize. "But get up there, there's a little fellow under you."

They were hauled and rolled off him, and Tom was discovered a motionless body.

Old Brooke, the captain of the eleven, picked him up.

"Stand back, give him air," he said; and then feeling his limbs, added: "No bones broken. How do you feel, young 'un?"

"Hah-hah," gasped Tom, as his wind came back, "pretty well, thank you—all right."

"Who is he?" said Brooke.

"Oh, it's Brown, he's a new boy; I know him," said East, coming up.

"Well, he's a plucky youngster, and will make a player," said Brooke.

And five o'clock struck. "No side," was called, and the first day of the School-house match was over.

THE NEW CHUMS GOSSIP BY THE FIRE AND PREPARE FOR "THE SINGING"

Tom soon recovered from his shock, entering with real zest into the life of the school. Over the fire they sat discussing the great match and other adventures of the football field until it was time to go to their rooms and wash up for the singing.

"What's that?" Tom asked; and East explained that on the last six Saturdays of the term there was singing, as there were no first lessons to do, and "you can lie in bed to-morrow morning."

"But who sings?" asked Tom.

"Why, everybody, of course; you'll see soon enough. We begin directly after supper and sing till bedtime."

Supper-time came in due course at seven o'clock. The meal consisted of bread and cheese and beer, which were all saved for "the singing"; and directly afterwards the fags went to work to prepare the hall. Each new boy of that term was placed on the table in turn and made to sing a solo, under the penalty of drinking a large mug of salt and water if he resisted or broke down. Tom sang an old West-country song, "The Leather Bottél." Many jolly songs were sung, particularly when the fifth and sixth form boys came in, and old Brooke, who was already a hero to Tom, made quite a good little speech as he was so soon to leave the school after eight years.

"Now, I'm as proud of the house as anyone," he said. "I believe it's the best house in the school, out-and-out. But it's a long way from what I want to see it. There's a deal of bullying going on, and, depend on it, there's nothing breaks up a house like bullying. Bullies are cowards, and one coward makes many; so good-bye to the School-house match if bullying gets ahead here."

TOM BROWN COMES IN FOR HIS TOSSING IN THE BLANKET

Old Brooke's speech, which was quite a long one for him, was received with great applause and approval, and many glances were made in the direction of Flashman and other fifth form boys who delighted to bully their juniors. The singing meeting was ended by the entrance of the head-master, cap on head and book in hand, who led the whole company in prayers, after which they indulged in the time-honored custom of tossing the new boys in a blanket, an ordeal through which Tom went without flinching.

Thus began Tom Brown's life at Rugby, and a more exciting day for his entrance there could not have been chosen. He shared the fun of it with the new boys who had been there from the beginning of the term. The sermon which he heard the doctor preach on the Sunday revealed to him the strong and noble character under whose guidance he had been placed. For every boy in the school was sooner or later bound to come into personal touch with the head-master. Tom was installed in the third form, but

as he had already been well grounded in grammar, the master considered he had been placed too low, and gave so good a report of him at the end of the term that he won his remove to the lower fourth, where all his School-house friends were, so that his delight in being a Rugby boy was now supreme.

When Tom returned to Rugby for the beginning of the second term, and found himself the possessor of a desk in the lower fourth, that was something of a temptation to him, as he used the desk for other purposes than study, and was thrashed in consequence, while the whole form made a very poor appearance before the head-master at the monthly examination. Tom's reputation for steadiness suffered in consequence, but there was another direction in which he ought in fairness to have recovered his good name.

THE TWO CHUMS TEACH SOME OF THE BIG BULLIES A NEEDFUL LESSON

Flashman, the most notorious of the bullies, was so unfair and even brutal to the younger lads whom he made to fag for him that Tom and East, on whom the bully had also tried his work, decided to rebel, and maintained a steady opposition to Flashman and his friends. It was not that they objected to doing the duty of fags, which was expected of them by the fifth form, but simply as a protest against the bullies, and the youngsters succeeded in inflicting a severe punishment upon Flashman.

But the result of it was that Tom and East gained the reputation of shirking fag duty, and Tom, having broken other rules of the school, particularly one as to fishing from a prohibited part of the River Avon, found himself before the head-master and in danger of expulsion, unless he undertook to mend his ways. This he did, and was as good as his promise, for on his return to school next term he was invited by the wife of the head-master to take tea with her, and was told he was to have the Gray study, which was a favorite one, and that she would like if he would take under his care a new pupil, named George Arthur, who was in delicate health, and had never before been away from home. Somewhat reluctantly, Tom undertook this responsibility, as it would interfere with other private plans of his. Arthur proved a gentle young lad, who, in the dormitory that night, unlike most of the boys, knelt by the side of his bed for prayers, and was jeered at in consequence by one of the others, who threw a slipper at him. Tom quickly met the situation by letting the boot he had just pulled off fly at the head of the bully.

TOM AS THE CHAMPION AND DEFENDER OF ONE OF THE NEW BOYS

"If any fellow wants the other boot," he exclaimed warmly, "he knows how to get it!"

The little scene had an influence on some of the boys in the room, and on Tom most of all. Next morning he began the day by silent prayer at his bedside, and there were others who followed his example. This was the immediate result of his taking care of Arthur.

Arthur was greatly interested in birds and animals, and soon made friends with Martin, one of the school's curious characters, who tamed snakes and kept birds in his study. Together they went exploring in the woods, and Tom had more than once to get them out of scrapes. It was over Arthur, too, that Tom had his last fight in the school with a bully named Williams, who had promised to thrash little Arthur for some fancied insult. He was challenged by Tom, and the fight was at its hottest, with Tom getting the best of it, just as the doctor arrived to put a stop to it. Williams profited by the encounter, as it cured him of his bullying, and made him a firm friend of Tom's.

THE HAPPY TRIO, AND HOW THE WEAKEST HAD THE GREATEST POWER

Two years after the events recorded, Arthur, who was now sixteen, and was an apt and bright scholar, was at the head of the twenty. Both Tom and East were far less successful in their studies, and were none too highly placed in the fifth form. It was a very happy friendship, however, for Tom and East, with their fine manly characteristics and their physical powers, felt the refining influence of Arthur's gentler nature, and were the better in consequence, while he was sheltered from the buffetings of the school by having such manly chums.

Arthur was one of several scholars who took the fever and had to be sent home until he was recovered. Before going away he said to Tom there was one favor he had to ask of him. It was that he would give up the *vulgus* books and cribs, by which he meant that Tom had not been doing his Latin and Greek exercises honestly, but using translations. Tom looked away at this, and then, catching his friend's gaze, asked: "Why?"

"Because—because you're the honestest boy at Rugby, and that isn't honest."

Arthur soon brought Tom to his way of thinking, and had his promise. East had also been guilty of cribbing, like Tom, but he was now brought to honest study as the result of Tom's promise to Arthur, and from that time forward both derived a satisfaction and pleasure from their studies which before had been unknown to them.

TOM'S LAST YEAR AT RUGBY SCHOOL, AND WHAT HE LEARNED THEN

So two more years passed away, and it was again the end of the summer term. An important cricket match was to take place, and there was a union of old boys. On the slope towards the cricket ground stood three of the elder scholars. There was one slight of build, with bushy eyebrows and a dry, humorous smile, while by his side was another of manly form, almost six feet tall, tanned of face, with curly brown hair and sprouting whiskers, his laughing eyes gleaming below his smart straw hat. He was dressed in a white flannel shirt and trousers, with the captain's belt about his waist, and on his feet were yellow cricket shoes. This was our hero, Tom Brown, now nineteen, a præposter, or monitor, and captain of the eleven. East was he of the bushy eyebrows, and the third slight but well-knit and active figure was Arthur, greatly improved physically and as bright as ever.

The master of Tom's form came up just then and invited Tom to sup with him. At that meal Tom learned for the first time how the great and noble man who was the head-master of Rugby had carefully planned for the molding of Tom Brown's character. Tom had fondly supposed his progress was due largely to his own foresight, but now he could understand that it was by choosing him as a protector of Arthur, thus giving him a new sense of responsibility and trusting him, and by many other little things, which he now saw in a new light, that the great Dr. Arnold had brought out the best of what was in his scholar's nature.

AFTER HIS RUGBY DAYS TOM MAKES A PILGRIMAGE TO THE OLD SCHOOL

It was the year 1842, when Tom was on a fishing holiday in the Scottish Highlands, that his companion, reading from a newspaper, said: "Here's something for you, Tom. Why, your old master, Arnold of Rugby, is dead."

"Let me look at the paper," said Tom, greatly agitated, and, turning over the leaves with trembling hands and swimming eyes, he managed at length to read the short announcement. Reading it again, he walked rapidly towards the inn, consulted the steamboat and railway guides, and, hastening to his room, was gone in an hour. In a day and a night he had reached Rugby, and at the school he found the old verger, Thomas, who looked up at him through his spectacles, and Tom seized his hand and wrung it.

"Ah, you've heard all about it, sir, I see," said the verger.

"Yes. Where is he buried?"

"Under the altar in the chapel, sir. You'd like to have the key, I fancy."

THE DEATH OF THE HEAD-MASTER, AND HOW IT AFFECTED HIS OLD PUPIL

In the chapel all was still as death, and, groping his way almost blindly there, Tom went to his old seat and bowed his head, while the tears came quickly to his eyes. A strange sense of loneliness was with him, the consciousness of a great loss. At the altar he prayed until he felt the peace that comes from prayer, and then, going out into the fresh air, he walked about the close and the cricket fields and up to the old school grounds. Nothing was changed, yet the saintly Dr. Thomas Arnold, the life and soul of it, was no more.

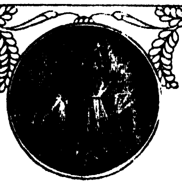
But the teaching of him who was gone still endured and influenced the young man who stood there, conscious that what remained for him to do was enough for all: to labor and be true and strong.

THE NEXT FAMOUS BOOKS ARE ON PAGE 4223.

"Their Furrow Oft the Stubborn Glebe has Broke."

THE LIFE OF THE EARTH

CONTINUED FROM 4011



EVERY year a miracle takes place before our eyes. We look over the country one day, and as far as we can see the earth is dull and brown, the bare branches of the trees point their skeleton fingers toward the sky, except where the dark, sombre evergreens stand out in the gray-brown landscape. Here and there patches of snow still cling to the hillside, or lie in the woods.

A warm wind comes up from the South, and breathes upon the snow. It disappears, and then the rains come, not hard and cold and dreary, but soft and gentle; the earth and air seem saturated with water. The air is not clear, but hazy, and the distant hills are not sharp and clear. The sun shines and the air is filled with mellow light. We say that we can feel the promise of spring.

THE GLORY OF SPRING BURSTS UPON US

A few of these warm, balmy days pass, and we look out on the fields again, but they do not seem the same. We cannot say that they have changed much in color, but they no longer appear cold and unfriendly. We stoop down and discover the reason. Under the old dead grass is a sprinkling of yellow green. New shoots are pushing up from the earth. The trees seem veiled, and the branches are no longer harsh and ugly. The young shoots look different, and here and there are little knobs. Another week and the yellow sprays of the forsythia sway in the wind. Violets are under our feet. The peach blossoms spread their pink glory over the orchards, the pink and white apple blossoms scatter their scent everywhere. The blossoms of the elm and the oak are in the air or on the ground. Tender green leaves push themselves out on the twigs. Spikes of green stand like soldiers in the flower beds, and the jonquil, the daffodil and the narcissus burst out. The dandelions dot the grass like yellow stars. The full glory of spring is upon us.

How it happens no one can explain. The bulb which was placed in the earth in the fall had all the glory of the flower concealed in it, but why one bulb should develop into a yellow tulip, another should be red, and another white, no one can explain. One of two seeds, apparently exactly alike, swells, sends out rootlets, which spread around under the earth, and a spike which seeks the light; another lacks something and lies in the earth until it rots and goes back to the earth from which it came in the first place.

We say that one has life in it, and that this life under favorable conditions of warmth and moisture bursts out of the shell, and seeks to grow. The other

seed, or grain, has lost its life and will not grow. When you plant a bed with flower seeds, when a farmer buries his seeds in the ground, some of the seeds will send out roots and stalks, some will remain where they are placed until they are destroyed. Why this is true, the wisest man cannot tell.

WHAT A PLANT MUST HAVE IN ORDER TO GROW

Our pictures show you how the earth is prepared for the seeds. We know that a seed must have many things in order to grow. It must have warmth, moisture, phosphorus, nitrogen, iron and potash, and many other things. Some of these the plant cannot use in their pure form, but must take them from combinations of these substances with other things. If the same crop is planted year after year in the same field, it takes all of some of these substances which the ground has to give, and the plants do not thrive. If we wish the seeds to give us back many seeds, we must supply food for the plants. This is one of the most beautiful things in nature.

One of the best foods for plants is manure from the stables. The animals do not use up all the valuable substances in the food they eat. This waste, mixed with the straw or leaves of their bedding, is mixed with the soil and the plants eat it greedily. It also helps the plants to feed on substances already in the soil. Many other things give the substances which plants feed upon. There is much nitrogen in the blood from slaughter-houses, in cottonseed meal, and in the fish heads and other waste from the fisheries. Then, too, we can get the nitrates from the deserts of Chile, and from other places. We think of some of these as ugly things, but this is a foolish thought. If Nature did not use the same things over and over again, this earth would have become a desert ages ago; and is it not beautiful that these unpleasant things can be changed by Nature's wonderful chemistry into the fragrant rose or the nourishing wheat?

Plants must have a great deal of phosphorus. In many places there is much of this substance in rocks, which are crushed to send to other places less fortunate. Ground bones give out their phosphorus to the growing plants. The waste from steel mills, which make steel from ores rich in phosphorus, is used also. The third substance which must be supplied to growing plants is potash. Some of it is dug out of the ground in some parts of the world, ashes from burned wood have a great deal, and some varieties of seaweed are burned to get potash.

DIFFERENT CROPS NEED DIFFERENT QUANTITIES OF THESE FOODS

Sometimes a soil needs all three of these. Sometimes it has enough of one, but needs the other two. Some plants need more of one than of another. Therefore, men mix these substances in different proportions for different crops. For example, wheat must have large quantities of nitrogen. Some crops, such as clover, peas and beans, can get more than enough nitrogen from the air, but they must have potash, and so must potatoes. Fruits need potash also. Cotton needs the phosphates, and so on. The farmer must know his soil, and what his crops need if he is to feed them properly.

But feeding plants is not all. They must be treated properly in other ways. So he must plough the land deep to loosen it, so that the roots of the plant can find their way through the soil. The lumps and clods must be broken up, so that the earth will lie closely around the seeds and roots, and so that the fine earth will hold in the moisture which would otherwise escape. Ground which is ploughed and harrowed until the earth is fine and smooth will produce larger crops than if it is left full of great lumps of earth or sod. Then, too, different seeds must be planted differently. Tiny seeds generally need only a slight covering; other seeds do better if they are buried deep in the soil. Some must be planted close together; others must have room to grow.

HOW NATURE'S MIRACLES TAKE PLACE EVERY YEAR

So the great miracles of life and growth go on year after year. The soil, the air and the water give up some of themselves to the growing plant. The plant in turn gives back what it has received. Sometimes it goes back directly, as when the plant itself is buried by the plough. Sometimes the plant may pass into the body of an animal, but this goes back at last, as it has been doing for countless years.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 4171.

In the United States are grown every year over 2,000,000,000 bushels of grain, some of which is sent abroad to help feed the nations of Europe. The first step in obtaining this great harvest is to prepare the ground, and here we see manure being scattered evenly over a large field by means of a machine.

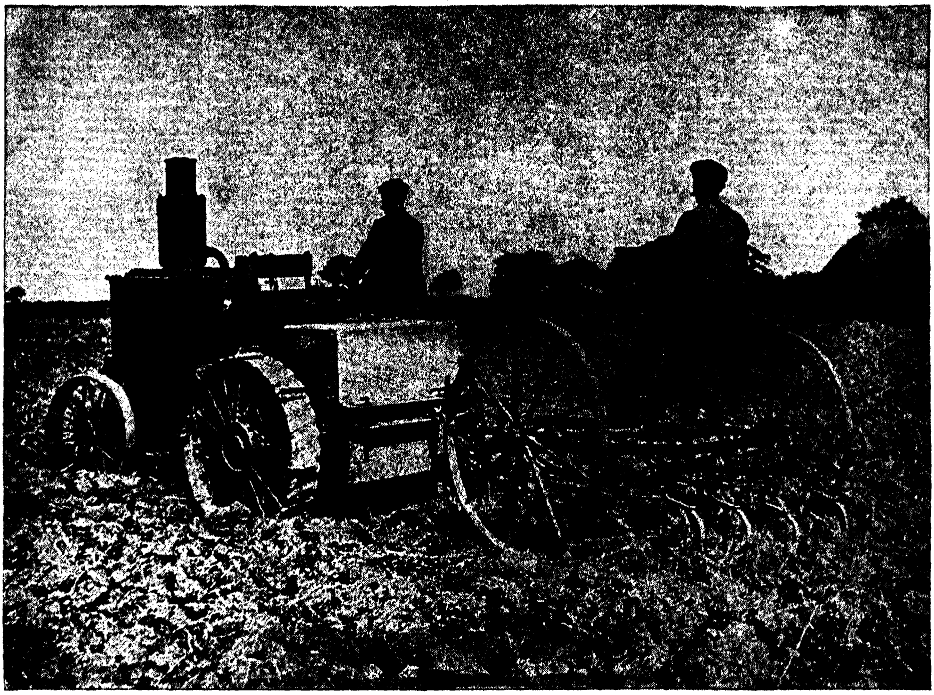
The old-fashioned method is to toss it about with a fork, as we see the man doing in this picture. But the machine does the work better and more quickly. Manuring is really feeding the soil. Science has taught us to make manure from chemicals, but the best food for the ground is the litter from farmyards and stables.

PLOUGHING WITH HORSES AND MOTOR

Soon after the harvest is gathered, the farmer begins to plough his land for the next, and sights like this are familiar. The plough is guided by the man who holds the handles, and the ploughshare cuts a furrow, and turns the soil over, so that the air, and sun, and rain can act upon it, and buries the grass and stubble.

On large farms other methods are adopted, and a whole row of furrows can be ploughed at once. This is done by using large ploughs fitted with several ploughshares, and in the picture we see two ploughs drawn by a motor-engine and guided by only two men. Eight or more furrows may be cut at the same time.

THE OLD STYLE OF SOWING THE SEED



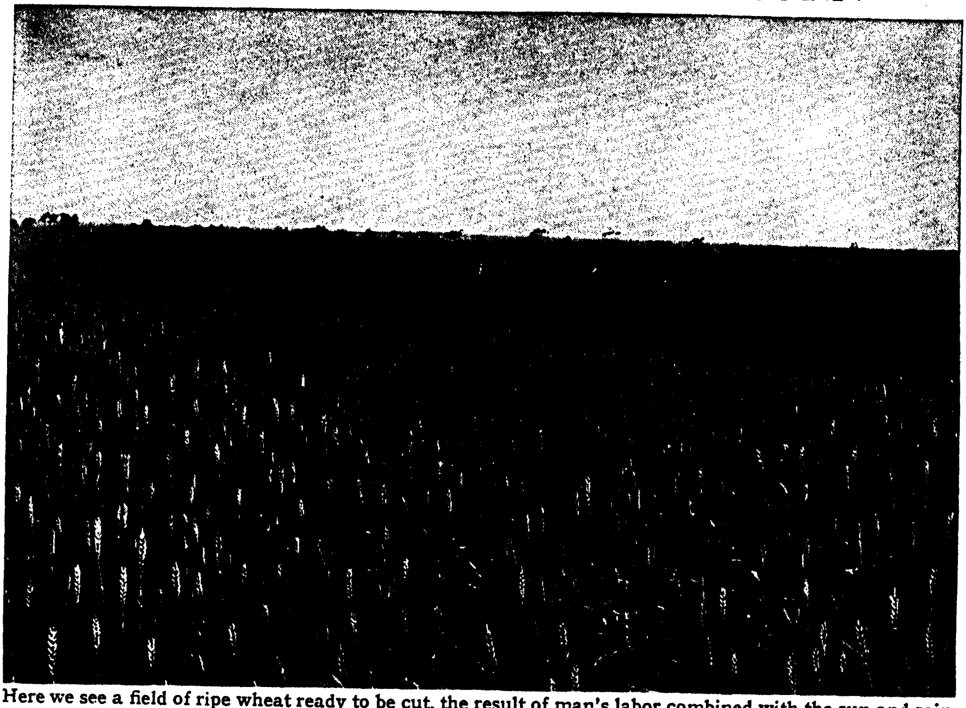
After the land is ploughed, and has been left to the action of the weather for a time, the clods of earth have to be broken up, the soil loosened, and the weeds destroyed. This is done by a machine called a cultivator, which has a number of steel prongs that tear through the ground, and do the work very quickly.

When the ground is quite ready, the seed is sown, and on some farms this is done by hand, just as it was in Bible times when the parable of the Sower was told. In our picture we see a man carrying the seed and casting it from him as he walks up the field. Of course, much of the seed is wasted when sown by hand.

THE NEW STYLE OF SOWING THE SEED

On most farms the sowing is done by machinery, and here we see a machine for drilling and sowing seed being filled with wheat ready for sowing a field. The seed is put into the ground a few inches deep by means of tubes known as shoes, which first of all drill holes for the grain. This method saves time and seed.

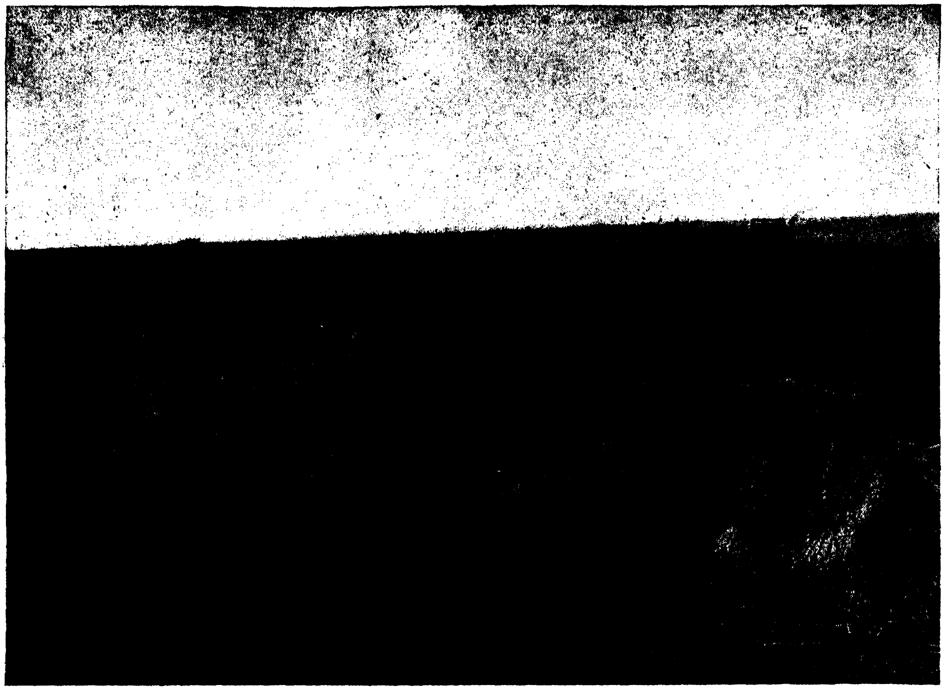
It was a long time before seed-sowing machines of this kind could be driven easily and smoothly over the ground as is being done here. The tubes that placed the seed in the soil used to catch in obstacles and stop the machine. But when the tubes were made like shoes, they were able to cut through or rise over obstacles.



Here we see a field of ripe wheat ready to be cut, the result of man's labor combined with the sun and rain. There are few finer sights in Nature than the golden grain rippling and waving as the wind passes over it.

The ripe wheat used to be cut by hand with a sickle ; but now a wonderful machine, called a self-binder, is used, which not only cuts it, but binds the wheat into sheaves as the machine moves along. In this picture two self-binders are seen at work in a very large field that would take many days to reap by the old method. Other pictures which show how wheat is grown and prepared for market are on pages 1133-1136.

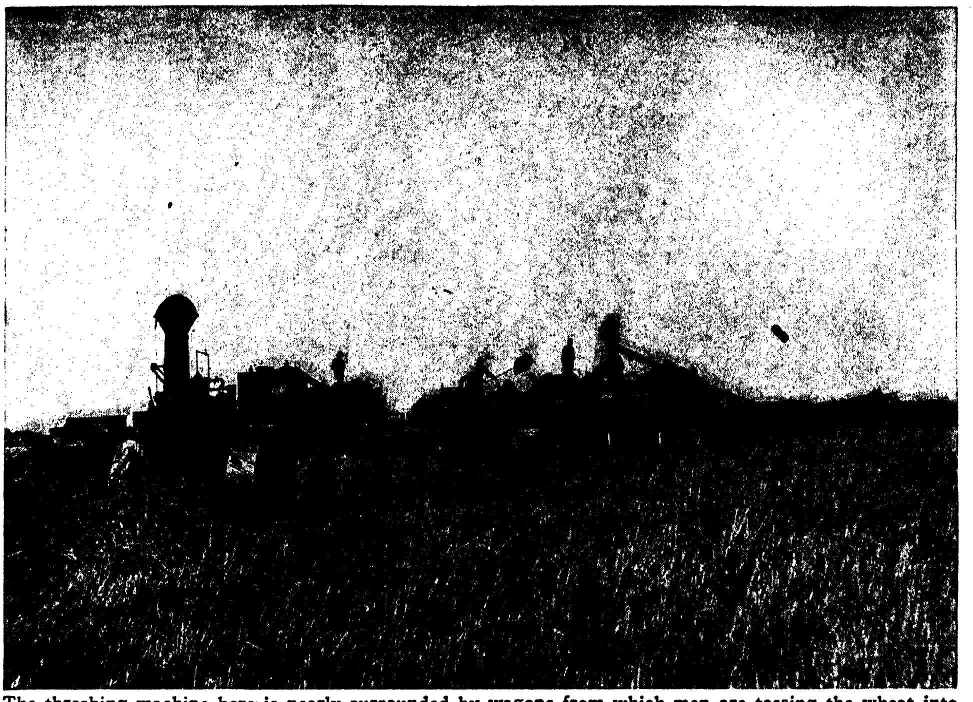
REAPING THE GOLDEN GRAIN IN THE WEST



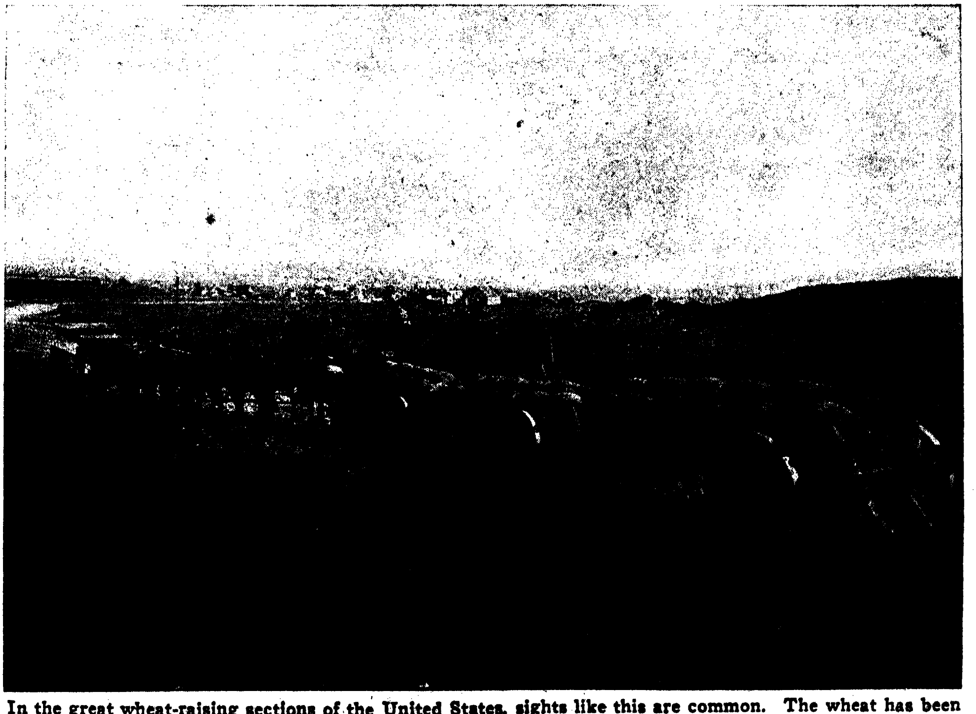
On a previous page you saw wheat being reaped on an ordinary farm. Here is one of the great wheat fields to be seen in the western part of the United States or Canada. The engine is pulling several reapers, and in the far distance many horses are also at work. The men are stacking the sheaves which have been thrown out by the reapers as they pass along. This field seems to stretch as far as the eye can see.

This is a closer view of the binders at work. As you see, the engine pulls four, each a little farther to the left than the other. Each cuts the grain in front of it, and binds it into sheaves, which are pushed out upon the ground. The engine runs upon ground from which the wheat has been cut. On page 1130 you may see a "combination" which not only cuts the grain but threshes it as it goes along.

THE WHEAT STARTS TOWARD THE MARKET



The threshing machine here is nearly surrounded by wagons from which men are tossing the wheat into its throat. Inside, the wheat is separated from the straw and chaff, and pours into the wagon on the right through the pipe you see. The engine which furnishes the power, burns straw, and requires the services of one man to feed it. The wire gauze cap over the smokestack prevents sparks from flying.



In the great wheat-raising sections of the United States, sights like this are common. The wheat has been weighed and the bags sewed up. Horses, or a traction engine, draw it to the railroad. It may be ground into flour there, or may be taken to a mill elsewhere, or perhaps may cross the ocean to feed Europe.

Pictures on pages 4150 and 4151 by Brown Bros.

CUTTING THE HAY FOR THE CATTLE

The hay harvest is an important part of the farmer's work. Hay is produced from the grass and mixed herbage of the meadow, and is used as food for horses, cattle, and sheep. It used always to be cut by hand with a scythe and drawn together for carting with a rake, but workers such as these are seldom seen to-day.

A machine like this is called a mower, and it can cut an acre of grass, for hay, in a single hour. It does not do the work so well as men using scythes, but it is so much quicker and cheaper than hand labor that nearly every farmer now uses a machine in his hayfields. Some machines cut a row ten feet wide.

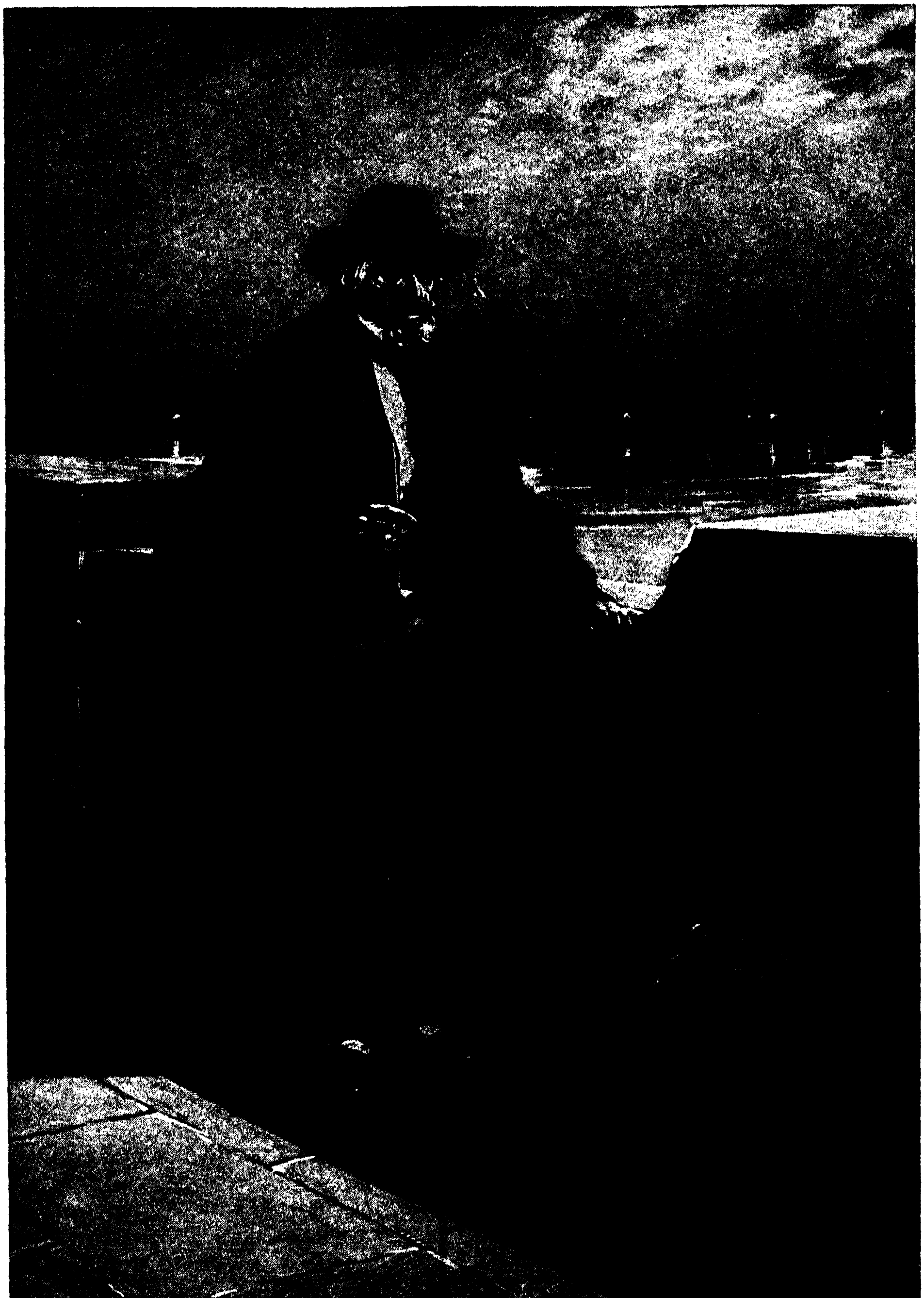
THE HAYMAKING AS IT REALLY IS

Poets, and others, who have written about the country, speak of haymaking almost as though it were a nice game in which men and women are laughing all the time. But it is hard work. A horse-rake goes quickly over the field, pulling the hay into rows, and then men with forks make it into heaps ready for carting.

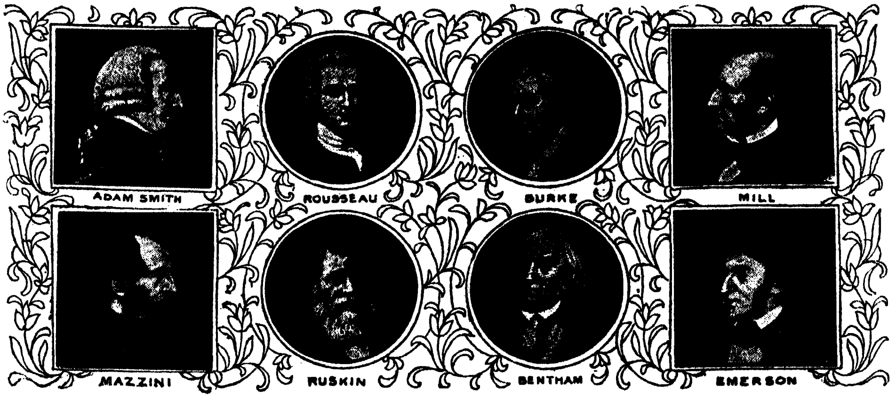
Before carting, the hay is left in the field for some time, so that the sun may dry it. It is turned over two or three times, and in this way all parts get the warmth and light. Then the wagon comes, and with two or three men working together, some throwing the hay up and others receiving it, the field is soon cleared.

THE NEXT FAMILIAR THINGS ARE ON PAGE 4171.

CARLYLE, THE MAN WHO DIGNIFIED WORK



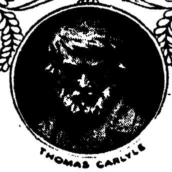
Few thinkers have influenced their age more than Thomas Carlyle, the rugged Scot who roared at the world and denounced hypocrisy. He preached the gospel of work, and some people thought he confounded might with right, but Carlyle always declared that this was the opposite of his teaching. Here we may see the aged "Sage of Chelsea," as Carlyle is often called, on the Thames Embankment near his home.



FAMOUS MODERN THINKERS

ROUSSEAU. BENTHAM. MAZZINI. BURKE. ADAM SMITH. MILL. CARLYLE. EMERSON. RUSKIN.

CONTINUED FROM 4108



On one occasion when Boswell had returned from abroad, Dr. Johnson said to him in a sarcastic tone: " It seems, sir, you have kept very good company abroad, Rousseau and Wilkes ! "

" My dear sir," answered Boswell, " you don't call Rousseau bad company. Do you really think him a bad man ? " Johnson replied: " Sir, if you are talking jestingly of this, I don't talk with you. If you mean to be serious, I think him one of the worst of men, a rascal who ought to be hurled out of society, as he has been. Three or four nations have expelled him, and it is a shame that he is protected in this country."

That is one view. Lord Morley gives another: " It was Rousseau who first in our modern time sounded a new trumpet-note for one more of the great battles of humanity. He makes the poor very proud, it was truly said. . . . It was in Rousseau that polite Europe first hearkened to strange voices and faint reverberations from out of the vague and cavernous shadow in which the common people move. . . . The race owes something to one who helped to state the problem, writing up in letters of flame at the brutal feasts of kings and the rich that civilization is as yet only a mockery, and did furthermore inspire a generation of men and women with the stern resolve that they would rather perish than live on in a world where such things can be."

A writer has described a visit to this Jean Jacques Rousseau on the fourth floor of a house in Paris: " We passed through a very small antechamber, where the household utensils were neatly arranged, and from that into a room where Jean Jacques was seated in an overcoat and a white cap, busy copying out music.

" He rose with a smiling face, offered us chairs, and resumed his work, at the same time taking a part in conversation. . . . Near him was a spinet, on which from time to time he tried an air. Two little beds of blue and white striped calico, a table, and a few chairs, made the stock of his furniture. . . . His wife was sitting mending linen ; a canary sang in a cage hung from the ceiling ; sparrows came for crumbs on to the sills of the windows which on the side of the street were open ; while in the window of the antechamber we noticed boxes and pots filled with such plants as it pleases Nature to sow. There was in the

whole effect of this little establishment an air of cleanness, peace, and simplicity which was delightful."

Two swallows built their nest in Rousseau's bedroom, and there hatched out their brood.

"I was no more than a door-keeper for them," he said, "for I kept opening the window for them every moment."

They used to keep on flying round about his head with a great stir until he had fulfilled this humble duty.

ROUSSEAU, THE STRANGE, BAD MAN WHO WAS GOOD TO THE POOR

Now, you will think that Dr. Johnson exaggerated when he said that Rousseau ought to be transported. But the truth is that Rousseau is one of those strange men about whom it is possible to hold two opinions, and those the most contradictory. Lord Morley, in his great book on Rousseau, quoted a verse of Victor Hugo's, which likens the soul of a man to a pool; in the still water is mirrored the sky tinged with heaven's fire, and beneath is the loathsome slime, where black and shadowy reptiles creep dimly through the dark. Such was Rousseau's soul.

Rousseau was an angel of light to the poor. He saw a world where men suffered, women grew spiritless, and children went hungry, cold, and ignorant; and where those who sought to make things better got lost in a maze of words. To Rousseau it seemed that one thing only was necessary—*to simplify.*

He wanted to simplify religion, so that all men might share its comfort; to simplify social relations by making all men equal; to simplify manners by homeliness and thrift; and to simplify literature and art, and life in general, by what he described as "a return to Nature"—that is to say, by constantly referring ourselves to Nature itself instead of to society and books.

THE MAN WHO SOWED THE SEEDS OF THE FRENCH REVOLUTION

He was stung by pain and suffering as Dr. Johnson could never be. "Worn-out horses," he exclaimed, "ready to expire under the blows they receive; wretched peasants, attenuated by hunger, broken by weariness, clad in rags; hamlets all in ruins—these things offer a mournful spectacle to the eye; one is almost sorry to be a man, as we think of the unhappy creatures on whose blood we have to feed." But if Rousseau felt these things more keenly than Dr. Johnson, he did not possess that great man's solid and lasting commonsense. Dr. Johnson was a good man. Rousseau was a bad one. To tell Rousseau's story, even in brief, would be to shock and disgust us. It is enough to know that the later years of his life were spent in some form of madness, the seeds of which were probably growing all through his youth and manhood.

We cannot explain these things. The great and virtuous Dr. Johnson never altered one cruel, wicked, or tyrannous injustice. Rousseau expressed the indignation of men and women against all these things. He helped the poor to gain self-respect, and perhaps did more than anyone else to aid the growth of the French Revolution, the great movement which altered the whole system of government in France.

THE GREAT WATCHWORD THAT JEREMY BENTHAM GAVE THE PEOPLE

He who invents a great phrase does more than preach a sermon, for a phrase that sticks in the mind is like a lever thrust under the thoughts of men in order to turn them into a fresh channel. The older we grow the more we shall see how mighty a thing it is to change men's opinions. Every man clings to his own ideas. Outside the radius of his own light all is darkness. And this darkness is not illuminated by long books and speeches glowing with fine words. It yields before the flash of a pithy sentence.

To Jeremy Bentham belongs the honor of turning men's minds in a new direction; and this he did by a single phrase. While but a few pored over his long books, the soul of Europe seized upon one single sentence therein and flashed it like a torch into the darkness that surrounded them.

This phrase was not strictly his own, but he it was who made it live. It runs simply enough: "The greatest happiness of the greatest number." Bentham wanted to find a reason for things—a reason for morality and a reason for law; he discovered it in this simple phrase. The object of morality and the object of law is the greatest happiness of the greatest number.

Before his day men thought loosely about such subjects. Law was to punish crime. Morality was what the priest ordained. Bentham revealed deeper foundations. Law did not exist to protect the rich man's purse from the thief, but to secure the freedom and happiness of all men. Morality was not born out of the clouds ; it was man's own discovery for the blessing and advance of the human race. All the efforts of government justified themselves only if they aimed to secure the greatest happiness of the greatest number. Does not this seem simple to us, and striking ? Even now happiness is regarded by many people as the exclusive property of the few.

But before Bentham's day the masses of people in the world were almost resigned to the idea that only the rich could be happy, and that it was to protect the rich that there were laws and morality. Jeremy Bentham developed the splendid thought of Bacon that philosophy must be the servant of humanity. He invented the word *utilitarian* to describe the only philosophy that was worth while, a philosophy that was useful to the human race. He did not believe in dreaming of ideas. He wanted philosophers to show the human race—the greatest number of the human race—how to be happy.

There are faults in the details of Bentham's theory. Some object to its main idea. We should have to agree first in what happiness consists before we could march forward. And we should have to remind ourselves of Bacon's noble saying, "Prosperity doth best discover vice, but adversity doth best discover virtue," before we could be certain of our goal. Nevertheless, our debt to Bentham is a great one, for he established both law and morality on a sure foundation at a time when men, ill-educated and made hasty and reckless by suffering, were inclined to hurry all such things to the fire of destruction.

And Bentham also gave to men the Christlike principle that they should consider the happiness of other people before everything else. If every politician, preacher, writer, and private person truly sought the greatest happiness of the greatest number, we should be within sight of the Golden Age.

A party of famous men at the house of Sir Joshua Reynolds, the first president of the Royal Academy. Reading from the left hand the names are James Boswell, Dr. Johnson, Sir Joshua Reynolds, David Garrick, Edmund Burke, Charles Burney, Paoli, the Corsican patriot, Thomas Warton, and Oliver Goldsmith.

Bentham was the son of a rich man, and was born, very weakly of body, in Houndsditch, London, in 1748. He read history when he was three years of age, and at the same time began to learn Latin. At six he was playing the violin, and he matriculated at Oxford when he was only thirteen. He loved music to the end of his days, and kept a piano in every room of his house. He was fond of flowers, and had many shady walks in his London garden. He was modest, hospitable, and simple in his conversation. He died aged eighty-four. His body was dissected—as he had instructed—and, after being embalmed and dressed in his usual garments, it was set up in University College, London.

Room must be found in this brief chronicle of great thinkers for the noble-minded patriot of Italy, Joseph Mazzini. He was a man who loved Italy above everything else on this earth, and God above everything else in the universe.

JOSEPH MAZZINI, THE PATRIOT THINKER OF ITALY

He spent his life in exile, was imprisoned, was banished from country after country, and for many years lay under sentence of death. But his faith never wavered. At the dawn of his manhood he founded a society called Young Italy, which was to work for the freedom of the country, then oppressed by foreign tyranny and torn by quarrels within itself. The motto of this society was "God and the People"; on its banner were the words "Unity," "Independence," "Liberty," "Equality," and "Humanity." From these ideals he never swerved.

His call came to him as he lay in prison. Looking out from his cell, he could see the sky and the sea. "Symbols of the Infinite" he called them. His only companion was a greenfinch; his only books were "a Tacitus, a Byron, and a Bible." In these circumstances it was that the call came to him, "God and the People."

The great work which he did as a patriot of Italy belongs to the world. His patriotism ennobled humanity. Every nation has been the better for his life. Mazzini was one of those great souls who recognize God in politics. He did not seek to make the Italians free only that they might earn more wages and work fewer hours; he preached to them a lofty gospel of duty to God and man; he set virtue always before their eyes. The mere political agitator, who sets class against class, would have felt the lash of Mazzini, who loved the common people because he always believed them to be the children of God.

EDMUND BURKE, WHO MADE MEN SEE THE PRINCIPLES THAT MOVED THEM

If we heard someone praising Edmund Burke, and asked what it was he did to deserve praise, the admirer of Burke would not be able to point to any definite achievement. He would not be able to say that Burke conquered this or that country, nor that Burke tore down a tyrant from a throne, nor that he wrote a book which has been the comfort and consolation of unhappy men. And yet the name of Edmund Burke remains one of the very greatest in the history of the world. He was only a voice, but a voice of power.

It has been finely said of him that he made great tides in human destiny very luminous. This meant that he could make men see the current of principle which carried them forward, make them aware of the reasons which moved them. The work of the great thinker is that of the interpreter. He interprets into human language the deep and obscure feelings of the soul. We know that we are often carried away by feelings, that we are often driven to do things without knowing why; it is the same with all men and women, and with nations. We are all conscious of being swept into certain actions, or of being intensely occupied by certain notions and ideas; but we cannot explain in simple language what it is that moves us.

HOW BURKE STOOD FOR FREEDOM AND HONOR AMONG THE BRITISH PEOPLE

Burke was one of the great interpreters of justice, freedom, and morality. The work of which he was proudest was the spirit of justice, freedom, and morality which he breathed into the government of India. He attacked before the whole world a great Englishman, Warren Hastings, for misconduct in India. This impeachment in itself was a small matter; the great result of it was that the whole of England realized its responsibilities in India for the first time. Burke made Englishmen feel the glory of freedom, the honor of justice,

BURKE SPEAKING AND EMERSON WRITING

Edmund Burke was a great political thinker. He believed in steady progress, but never ceased to denounce the French Revolution. The famous dagger scene in Parliament has become historic. Declaring that daggers were being made at Birmingham, he hurled one upon the floor of the House of Commons, exclaiming : " That is what you are to gain by an alliance with France." He was much laughed at for this action.

Ralph Waldo Emerson, our American poet and essayist, was one of the most original thinkers of the nineteenth century. He taught that the soul of man is the master of the intellect and the will, and by its illumination man can interpret the mysteries of Nature. A man of sweet and gentle character, he lived simply and quietly, and here we see him in his study, which was not only the study of a scholar, but the bower of a poet.

and the eternal necessity for morality. Ever since his day England has endeavored to govern her vast empire, not as something to make her rich, but as something for which she is responsible to God and humanity.

THE IRISHMAN WHOSE VOICE MOVED ALL EUROPE

Burke stood for the honor of the English nation when George III. would have taken away their privileges, and made himself an autocrat. Burke was on the side of France in the Revolution, till the justice of that movement clad itself in the murderer's dress and built its walls of freedom in the blood and agony of despotism. He was ever on the side of justice and freedom, but it was as a man conscious of righteousness.

Although he practically swayed Europe with his voice, he had no place of power in England. When Windham received one of his greatest books, he wrote in his diary: "What shall be said of the state of things, when it is remembered that the writer is a man decried, persecuted, and proscribed; not being much valued even by his own party, and by half the nation considered as little better than an ingenious madman?" Oliver Goldsmith made a mocking epitaph upon him:

Here lies our good Edmund, whose genius was such,
We scarcely can praise it or blame it too much;
Who, born for the universe, narrowed his mind,
And to party gave up what was meant for mankind.

Dr. Johnson said that you could not meet Burke for half an hour under a shed without saying that he was an extraordinary man. It is curious to relate that, at the end of his days, the king was going to make him a peer, with the title of Lord Beaconsfield. Before this happened Burke lost his only son, who was a foolish fellow. But this son was loved passionately by his father, who sank under the loss.

THE STORM OF SORROW THAT BOWED DOWN A STRONG MAN

"The storm has gone over me," he wrote, "and I lie like one of those old oaks which the late hurricane has scattered about me. I am stripped of all my honors; I am torn up by the roots and lie prostrate on the earth. I am alone. I greatly deceive myself, if in this hard season I would give a peck of refuse of wheat for all that is called fame and honor in the world."

One of his wisest sayings about government was: "The question with me is not whether you have a right to render your people miserable, but whether it is not your interest to make them happy."

This wonderful man was born in Ireland, and made his way in the world with no interest of any kind. His father refused to help him because he would not follow the law as a profession. By his own splendid powers, his devotion to work, and his faith in the justice of his cause, he rose to have a strong influence over all Europe.

ADAM SMITH, THE SIMPLE MAN WHOSE BOOK GAVE MEN NEW IDEAS

Adam Smith, a great writer on political problems, was a Scotsman, who was born on the 5th of June 1723. He was a great thinker, and one of his books, called "The Wealth of Nations," altered the ideas of men both in Europe and America. He was devoted to the working class, and was suspicious of tradesmen, merchants, and manufacturers.

"It is but equity," he says, "that those who feed, clothe, and lodge the whole body of the people should have such a share of the produce of their own labor as to be themselves tolerably well fed, clothed, and lodged." Also: "Our merchants and manufacturers complain much of the effect of high wages in raising the price, and thereby lessening the sale, of their goods both at home and abroad; they say nothing concerning the bad effects of high profits; they are silent with respect to the pernicious effects of their own gains; they complain only of those of other people."

This great and good man received honors on every hand, and retained his simple, modest, and useful habits to the end of his life, in 1790. He was a friend of Hume, the historian, and was known to the first minds in France. He became Lord Rector of Glasgow University.

John Stuart Mill was a man whose life will always remain one of the most interesting in human chronicles. His father, the son of a Scottish shoemaker, had raised himself by sheer force of literary industry to a position of importance in London. He had original

HOW JOHN RUSKIN TAUGHT HIS STUDENTS

John Ruskin was a daring and original teacher of art, and also a bold thinker on the problems of modern life. Although his views were often laughed at, it is now generally recognized that much of his teaching was right. While a professor at Oxford, Mr. Ruskin took his students out to break stones and make up the roads, in order to impress upon them the dignity of labor and to improve the appearance of the country.

ideas about things, and did not believe in schools. He educated his young son himself, and at three years of age John was learning the Greek language. The boy grew up in the companionship of this earnest father, and early in youth manifested singular powers.

THE SUDDEN THOUGHT THAT CAME TO JOHN STUART MILL

He was a man before he was a boy, and could hardly remember the time when he did not think. He received his "call" from reading a French translation of a work by Bentham. He set himself with enthusiasm to see the way which led to the greatest happiness of the greatest number. He wanted to make life happier and nobler, and he saw that the way out of misery could only be found by resolute thinking.

While he was striving with great enthusiasm for this grand object, a sudden chill struck through his soul. His soul asked the question: Suppose that all your objects in life were realized, that all the changes in institutions and opinions which you are now looking forward to could be completely effected at this very instant, would this be a great joy and happiness to you? He saw that this happiness lay in working for the grand end, not in the end itself. "I seemed," he said, "to have nothing left to live for."

So it must be with all philosophers and politicians who do not see that progress is infinite and eternal; that there cannot be any *end* at all, because man is immortal.

Mill found his work in seeking how to guard democracy from self-destruction. Many people thought that if workmen were given a vote the empire would fall to pieces, religion would be trampled underfoot, and the race of Englishmen would perish in sin. Mill did not think the danger was so great; but he certainly felt that something should be done to teach workmen, and, indeed, all kinds and conditions of men, that life was a serious and delicate experiment.

THE PLAIN PHILOSOPHER WHO MADE THE MULTITUDE THINK

The shouter at a street corner often knows nothing of history; he cares little what he says; he handles life as if it were a box of bricks. Mill saw that all men accepted the ruling of great men in the matter of science, and he thought it should be possible to form a science of politics, the masters of which would tell democracy what was right and what was wrong in the ideas of politicians. He wanted certainty.

All his chief work was in this direction. He failed; but it was a failure which is better than many victories. There can never be certainty in opinions, and politics is largely a matter of opinions. Mill, however, has taught men to be careful how they think, and still more careful how they speak. He has shown us the danger of words, and made us steady workers for change, instead of violent, hot-headed revolutionists. More than this, he set people thinking who had never thought before, and to those who did think he brought more subjects for their thoughts, and fresh ideas for their illumination. He was one of those quiet and self-contained philosophers who effect great reformations by making the multitude think.

THOMAS CARLYLE, THE SCOTSMAN WHO ROARED AT THE WORLD

A very different man from Mill was his friend, Thomas Carlyle. Carlyle had no lack of confidence in himself, no hesitancy about speaking. He opened his mouth and roared at the world. He was sure that what he had to say was the only thing worth saying, and, accordingly, he said it with energy.

Carlyle's gospel was the gospel of great men. The workman, armed with a vote and become master of the British Empire, was bid by this big-hearted Scotsman to study great men, to listen to the heroes, to bow before the divinities of the human race. While Mill was seeking, with laborious care, for certainty, Carlyle was shouting to the world that salvation lay in the worship of great men. He felt that he had read the riddle of the Sphinx.

There is much excellent truth in Carlyle. Huxley, the man of science, said that Carlyle's writings had saved him from becoming an idle and light-minded man, had made him earnest. But Carlyle rather overdid his gospel, for he preached energy to one of the most energetic nations on the face of the earth. He did not see the necessity for bringing home to men the need for modesty, gentleness, refinement, spirituality. He shouted, "Work!" to a working world. He preached the very thing that tends

to increase riches without destroying ignorance. But his influence for good was enormous. Carlyle is like some Old Testament prophet. His words burn and glow. His face seems to shine with the light of God. His was a voice raised up for eternity and immortality, at a time when men were losing faith in their high destiny. We cannot read him without feeling the spell of his words. He was full of a noble fervor. His soul was sure of God.

THE TERRIBLE MISTAKE OF A SERVANT AND THE HEROISM OF CARLYLE

There was one story about him which shows his courage. He had written the "History of the French Revolution," an immense work, and lent the manuscript to his friend Mill. By some terrible mistake this precious manuscript was burned by a maid in Mill's household. With this great misfortune all the toil and labor of years vanished in smoke up the chimney. When Carlyle heard it, he sat down and read Marryat's novels for a week; then he set to and re-wrote the History. Probably no other writer has ever had such a task to face.

His life was a long martyrdom to indigestion. His temperament was affected by this trouble, and he was not always as kind to his beautiful and brilliant wife as he might have been. She died in her carriage as she was driving round Hyde Park, after having received a telegram telling her of some great success of Carlyle in Scotland. Her death broke his heart. Filled with sorrow for his harsh treatment, he spent his last years in mourning for this lovely woman, whom death had taken from him. His last years, if not his whole life, were a tragedy. But his works live, and men will feel the power of his mind for many generations.

EMERSON, THE SMILING PHILOSOPHER, WHOSE FAITH WAS IN THE SOUL

Ralph Waldo Emerson, our American essayist, believed, like Carlyle, in the uses of great men. "The race goes with us on their credit. The knowledge that in the city is a man who invented the railroad raises the credit of all the citizens. But enormous populations, if they be beggars, are disgusting, like moving cheese, like hills of ants, or of fleas—the more the worse." Emerson began life as a minister of the Unitarian Church. This church believes in one God, and declares that Jesus is the supreme human Authority. Emerson believed passionately in one God. He remained to the end of his days a devout admirer of the character of Jesus, but he could not feel that Jesus was the only and supreme Authority. He taught that a man's own soul was the chief revelation of God. Soon, therefore, it became necessary for him to leave his church, and he turned to literature and lecturing for a livelihood.

His face is described as "radiant" and "angelic"; his voice was full of beauty and intensest music. Such a lecturer soon had the world at his feet. "Emerson," says one writer, "was a sweet-tempered Carlyle, living in the sunshine; Carlyle was a militant Emerson, moving amid thunder-clouds." Both believed ardently in a spiritual destiny for man; both felt with glowing fervor the glory and satisfaction of God. While Carlyle declaimed, Emerson smiled. Emerson had the beauty of a tranquil faith, and the composure of a soul that was deeply touched by the sense of eternity.

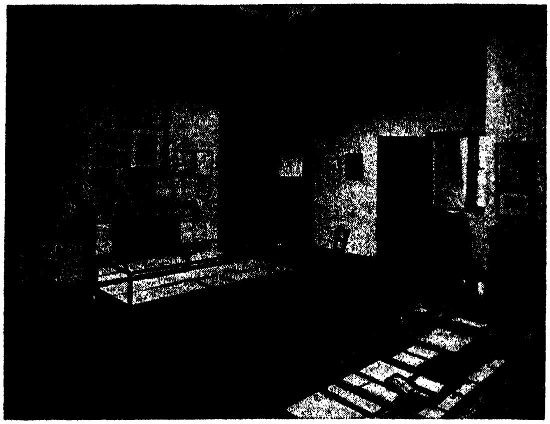
THE TEACHING OF RALPH WALDO EMERSON AND JOHN RUSKIN

The saying of Emerson, "Heroism feels and never reasons, and therefore is always right," expresses almost the soul of his teaching. He taught that no man can think or reason his way to the truth of the infinite universe. A good man, a pure man, whose soul is set to catch the splendor of God's power, will, on the other hand, find himself moved and influenced by the truth. "All goes to show," he wrote, "that the soul in man is not an organ, but animates and exercises all the organs; is not a function like the power of memory, of calculation, of comparison, but uses these as hands and feet; is not a faculty, but a light; is not the intellect or the will, but the master of the intellect and the will." His great faith was in the soul.

One of Emerson's most beautiful essays counsels men to follow the instruction of Jesus concerning prayer. "If he would know what the great God speaketh, he must go into his closet and shut the door," as Jesus said. God will not make Himself manifest to cowards. He must greatly listen to himself, withdrawing himself from all

the accents of other men's devotion. Even their prayers are hurtful to him, until he have made his own. This was his teaching, the direct relation between a man's soul and the God of the Universe. He inspired men to feel at home in the Infinite. He made them feel, too, that vice and cruelty and wickedness were base things, unworthy of them. Many people, of course, find fault with Emerson's opinions, but he remains head and shoulders above all other great moralists and essayists produced by America.

John Ruskin, the son of an English wine merchant, besides being a capable man of business, was fond of pictures, statues, and fine buildings. Mrs. Ruskin was a handsome woman, very severe in her ideas, ungracious in her manner, but entirely excellent in devotion to duty. The little son of these parents had a strange infancy; his body, his brain, and his soul were watched over with an unceasing anxiety; he was not allowed to play with toys; his intellect was trained from the very first to observe Nature and reflect upon what he saw; many times he was whipped as a boy.



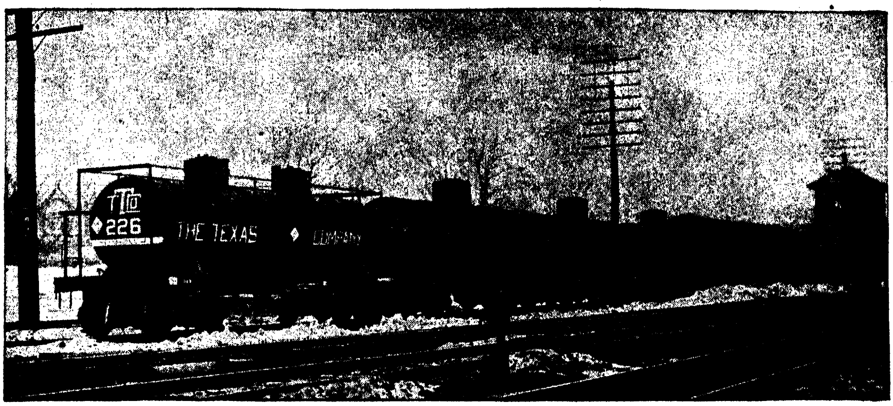
The study at the top of his house in Chelsea, where Carlyle used to escape from the noise of the hawkers in the streets.

Thus trained, he grew to be extraordinarily clever, particularly in all matters relating to art. He became an enthusiastic worshipper of great buildings and noble pictures. He conceived the theory that buildings and pictures are the outward and visible signs of a nation's inward and spiritual feelings; buildings and pictures *express* a nation's religious feelings. His books on these subjects made him famous while he was still young.

Then came the natural next step. From the glorious buildings of the past he turned to those of the present—to the factory town, with its hideous chimneys, its blackened walls, its dreary streets of unmingled ugliness; and he condemned the whole system which could produce such a state of things. He attacked men of science and politicians; he said that they were wrong; he denounced their philosophers, and derided their "laws of economy." It was enough for him that modern life wore a sooty coat and went on broken boots. He wanted sun, rose-colored clouds, green pastures, and palaces of stone. He condemned the world.

But when with lavish generosity he himself endeavored to set up model factories, the efforts proved a sad failure. No, not a failure; there is no failure in the work of a true soul. Although the co-operative and socialistic attempt at a model industry came to an end, the idea lived, lives now, gathers in force, and it may at some time rule the world. For man does not live by bread alone. As the race advances, it feels how unsatisfying are the mere wages of labor. Each generation, a little better educated than the last, feels itself carried forward to a goal more honorable than that which satisfied the past. Beauty becomes a religion. Ugliness wears the look of sin. This was Ruskin's work. It may be regarded as in some ways the greatest work of modern times. His long life was loyally spent in bringing home to the business and bosoms of men the thought of beauty—beauty in buildings, in paintings, in vesture, in manners, in conduct. Ruskin's fight for this object was a strenuous one. The forces against him were enormous—the forces of mammon, prejudice, and ignorance. But he neither stumbled nor quailed. His gospel has spread to other nations; his ideas are growing in the minds of every class. We cannot doubt that the present system, which makes life so hideous and dull, will pass utterly away and Ruskin's gospel of beauty become part of the religion of humanity.

THE NEXT STORIES OF MEN AND WOMEN ARE ON PAGE 4315.



HOW WE GET KEROSENE

CONTINUED FROM 4062

UNLESS your house is furnished with gas or electric lights, you probably have lamps which burn kerosene. The great majority of the people of the United States use the light of kerosene lamps, as gas and electricity are seldom supplied except in cities or towns. Candles are troublesome and expensive, and acetylene gas requires some care.

WHAT DO WE MEAN BY KEROSENE?

Now kerosene is only one of the products of petroleum. This last word means "rock oil," and was once thought to be mineral in its origin. Now we know that it is closely connected with coal and is usually found in its neighborhood. Petroleum has been known for hundreds of years, but it is only recently that kerosene came into use. Your grandfather can no doubt remember when it first was offered for sale.

HOW PETROLEUM WAS FIRST OBTAINED

The early explorers of what is now the United States found petroleum oozing out of the ground or floating on the surface of the water, in several parts of the United States. They found that the Indians rubbed their bodies with it, and said that it made them active and quick. So when this country became settled the whites also began to use the oil.

Sometimes they laid blankets on the ground where the oil appeared and then wrung it out of them. Sometimes they skimmed it off the surface of the water. The quantity they gained was small. It was then sold by pedlers at a high price, as Seneca Oil, Indian Oil, or some such name. It was rubbed on the body as a cure for rheumatism, or taken as a medicine. Few families would use more than a pint in a year.

The men, boring wells to get salt water in Western Virginia in 1806, found much petroleum along with the brine. This caused a great deal of trouble here and at other places, but no one seems to have thought of using it except as a liniment or as a medicine for many years. Finally in 1848 Samuel M. Kier had some of the thick substance distilled and secured an oil which would burn in a lamp, though it had a horrible odor. It was called carbon oil and sold for a dollar and a half a gallon.

Now people began to sink wells to get the petroleum, but the natural gas

which sometimes appeared with the oil caught fire and caused an explosion. The oil was now sometimes used to make machinery run more smoothly, but still the business did not grow rapidly.

THE FIRST APPEARANCE OF THE WORD KEROSENE

In 1846 Dr. Abraham Gesner obtained an oil from coal which he afterwards called "kerosene," and a company was organized to manufacture it. The company was successful and other oil-works were established. The demand grew and Doctor Silliman, of Yale College, was employed to find out whether there was any likeness between coal-oil and petroleum. He conducted his experiments on Oil Creek in Pennsylvania and reported that petroleum furnished excellent oil for burning. Samuel M. Kier had sold some oil for burning in 1848 and two years later James Young got some oil from shale which would burn.

People began to want more of this oil, and a company was organized to take oil from a spring in 1854, and in 1856 it was determined to try the experiment of boring a well deep into the earth. The company employed Edwin L. Drake to superintend the work. This man had been a railway conductor, who had resigned because of ill-health. A new company was organized, and, finally, in 1858, Colonel Drake, as he was called, though he had never been a soldier, arrived in Titusville, Pennsylvania, and tried to begin boring the well. Tools could not be had, and not until May, 1859, did work really commence. A tube was driven down to the rock and the workmen began to drill, accomplishing about three feet a day.

HOW THE FIRST WELL WAS SUNK

Money was scarce and at one time it was thought that work must be given up, but Colonel Drake was determined to go on and borrowed the money necessary to keep the drillers at work. On Saturday, August 28, 1859, the drill seemed to move easily just before the workmen stopped for the day. Sunday, one of them visited the well and found that it was nearly full of oil.

TOWNS IN THE OIL REGION SPRING UP IN A NIGHT

A pump was attached on Monday and the well was found to yield twenty barrels a day. The whole region went wild. Every foot of land along the creek was bought or leased by men who intended to drill for oil. Wells were sunk in every direction. The town grew in a few months from a population of a few hundred to fifteen thousand. Many men grew rich almost at once. The news spread and men in other sections where oily springs had been found also sunk wells.

THE LAST DAYS OF COLONEL DRAKE SPENT IN POVERTY

The Drake well did not last many years. Gradually the yield grew less and less, and finally gave out altogether. Colonel Drake had thought that it would be permanent and did not try to buy or lease other land. Finally he left the oil regions with $16,000, which he afterward lost, and for a time was very poor. When the men who had gained millions in the oil business heard of his poverty, they raised some money for him and the legislature of Pennsylvania voted $1,500 a year as long as he or his wife should live.

In other sections a different kind of oil was found. This was thick like molasses, and was used only to make machinery run more smoothly, and to-day the wells in the Franklin district send their oil over the world. A third kind of oil, which could be used both for light and machinery, was soon dicovered. Some of the wells spouted oil. In all, hundreds of wells were sunk in the district, and oil was also found in West Virginia and Kentucky. Soon refineries were established to separate the oil into its different parts.

A MATCH SOMETIMES CAUSES A FIRE

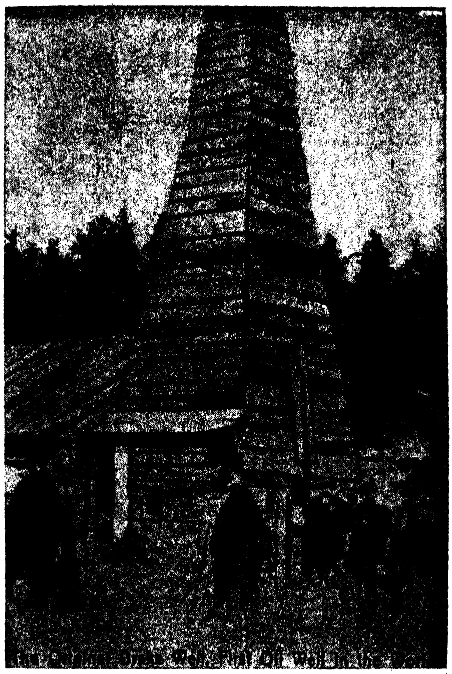
Many accidents occurred in the oil country in the early days. Much oil was wasted and ran out in the ground. Every building around an oil-well was saturated, and when a match was carelessly thrown down, sometimes a great fire occurred. Occasionally a tank was struck by lightning. We show you a picture of that accident. Now more care is taken and fewer accidents occur.

In later years oil has been found in many states. New York, Indiana, Illinois, Ohio, Kansas, California, Oklahoma and Texas produce oil in large quantities.

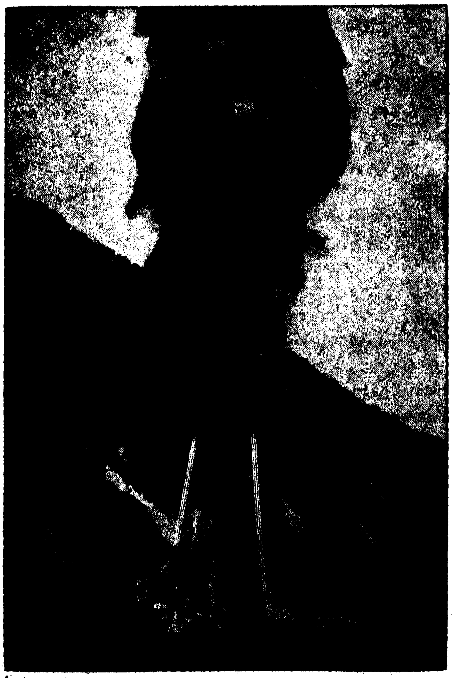
WHAT IS MEANT BY "TORPEDOING A WELL"

In the days when wells were drilled for salt water, it was found that by exploding powder in the bottom of the well, sometimes more water could be secured. The

EARLY DAYS IN THE OIL INDUSTRY



This man, Colonel Edwin L. Drake, drilled the first well for oil near Titusville, Pennsylvania, in 1859, and with this well, which you see to the right, the great American oil industry began. Before this time oil had been used chiefly for medicine or as a liniment, though a little had been used for lighting purposes.



Here is an oil well which has just had a charge of nitro-glycerine exploded at the bottom. The picture to the right shows a burning oil-tank, which was struck by lightning. When a tank catches fire, it must burn until the oil is exhausted, as water only spreads the flames. Sometimes oil on the surface of water catches fire.

same experiment was tried with the oil-wells and was often successful. At first powder was used, but it was soon found that nitro-glycerine was better. This substance is a mixture of nitric and sulphuric acids, and glycerine, and is very powerful. A few drops will wreck a house if it is struck sharply. It does not always explode from fire. It is let down into a well and a little powder is put in a cap on top. Then a little iron weight is dropped. The explosion shatters the rocks in the bottom and cleans out the paraffine which had clogged the well. Sometimes wells which had before furnished only a few barrels a day, yielded hundreds after an explosion of this kind.

In order to increase the flow of an oil-well, a charge of nitro-glycerine is often exploded at the bottom. Here we see the men pouring the fluid into a tin cylinder. It is then carefully let down to the bottom, and then a weight is dropped down the tube. The resulting explosion often sends a fountain of oil high into the air, as you can see on another page. Sometimes the flow is permanently increased, but often the greater production does not last. Photograph copyright by Keystone View Co.

One trouble which developed was the cost of carrying the oil. The roads were bad and the teamsters charged high prices for carrying the oil. Then too the barrels were expensive and not many of them could be carried on a freight car. So wooden tanks were built upon the cars, and then iron tanks like a boiler were built. Every stream in the oil region had a fleet of flat boats which carried oil to the market.

SENDING OIL TO MARKET UNDER THE GROUND

Only a year or two after the oil-wells were opened, a man thought of the plan of running the oil to market in a pipe. The teamsters, angry at seeing their business broken up, destroyed the first pipes and sometimes there were riots. But the new plan saved so much expense that others were built and now there are thousands of miles of pipes running from the oil-wells to the refineries, or to the sea coast. Lines reach from the oil country to New York, Philadelphia, Baltimore, Cleveland, Buffalo and other cities. In Pennsylvania alone there are more than 25,000 miles of line, and there are many more throughout the other regions. Lines have been laid from Kansas toward the East; they carry oil from Oklahoma to

the Gulf of Mexico, and from the wells in the mountains of California to the Pacific Coast.

Every few miles are powerful pumps which drive the oil onward. Sometimes the paraffine collects on the sides of the pipes and almost clogs them up. When this happens a little machine with sharp, revolving knives is put into the pipe. The pressure from behind pushes it along and the inside of the pipe is scraped clean. This is usually called a "go-devil."

Oil is exported in large ships called tanks. These ships are built with reservoirs to hold the oil, and in many of them the engines use for fuel some of the oil that they carry. A great deal of oil and kerosene is sent from place to place along our coasts in barges, which are towed by powerful steam tugs, and quantities are shipped over the railroads in large tank cars. Kerosene is also sent all over the world in tightly closed tin cans which are known from the farthest north to the farthest south that people live.

WHERE DOES PETROLEUM, OR ROCK OIL, COME FROM?

But, you ask, how was the oil made, and where does it come from? Are there wells or reservoirs, below the ground, in which it is held imprisoned? We shall answer the last question first by asking you to make a simple experiment. Take a piece of hard cardboard, or a bit of pumice stone or hard clay, or a piece of soft stone, if you can find it. Pour a few drops of oil on the object, whatever it may be, and see what will happen. As you watch, the oil will disappear, leaving only an oily spot where it has been. The oil has not evaporated, however, as water would do. The object on which it has been lying is porous, and the oil has sunk into the pores and saturated them. If you could put pressure enough upon the object with which you are making the experiment you would get the oil back again. This little experiment will help you to understand the answer to your question. In most of the oil regions great masses of porous sandstone have been saturated with it, in others it is held by shale.

How it was made no one can definitely say. Most geologists say that both oil, and natural gas, which is often found near it, came from great masses of decayed vegetation, and fish, and other forms of sea life which were overwhelmed and buried deep by some natural convulsion in the days when the world was being made into its present shape. Others think that it came from volcanoes. There are other theories also; but the truth is that how petroleum was made is one of the secrets of nature which man has not yet been able to discover. Neither can we tell why when a well is sunk the oil should rush up the pipe and gush out.

Oil that is obtained from shale does not flow in wells. To obtain the oil the shale is mined like coal and is crushed, and heated in retorts, and the oil is distilled in something the same way that gas is distilled from coal. Nothing like the heat used to distil coal is needed, however.

The crude oil as it comes from the wells is very different in different places. The oil from some wells is quite light in color, in some it is amber-colored, and in some it is almost black. Also different things can be obtained from the oil that comes from different wells.

THE WONDERFUL PRODUCTS OF PETROLEUM

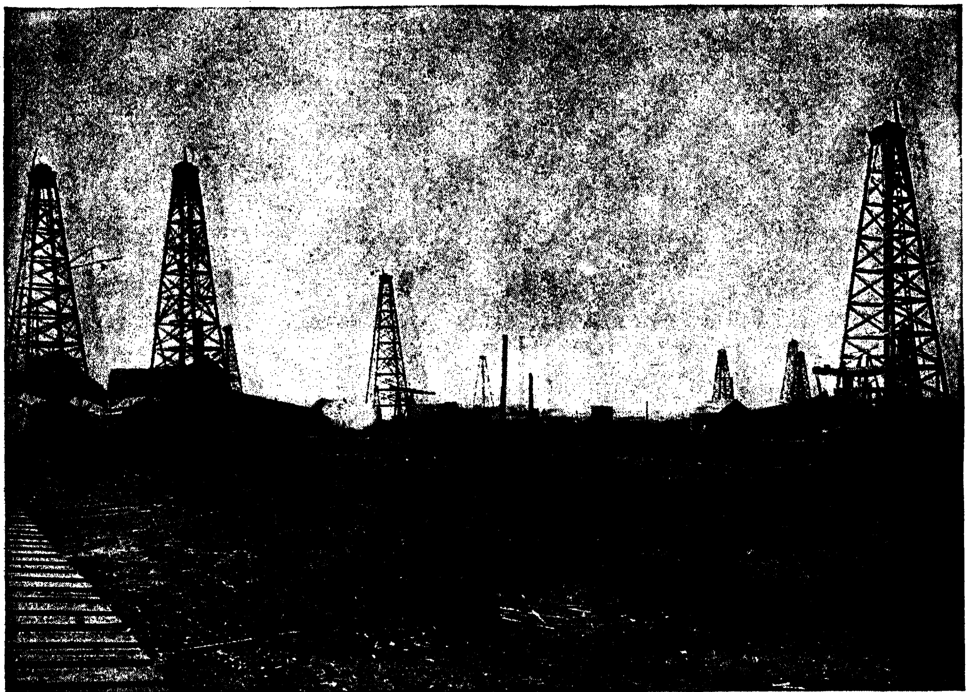
In the refineries, the crude oil is treated. Some of the oils will burn without refining, and some engines have been arranged to burn crude oil instead of coal. Many battleships use oil instead of coal, and as we have learned in the story of gas, large quantities of oil are used to make gas.

Oil is refined, in huge stills, by heat, which reduces it to vapor or gas, and causes the different things of which it is composed to separate from each other. Many different substances are obtained from it. The kerosene and gasoline that we know so well, and oil for machinery are the most valuable; but many other products come from it. Vaseline, benzine, soap, white wax for candles and other things, lamp-black, salves, and chewing gum are only a few of the well-known things that come out of the oil. Over two hundred things have been obtained from the oil, and chemists think they can separate many more.

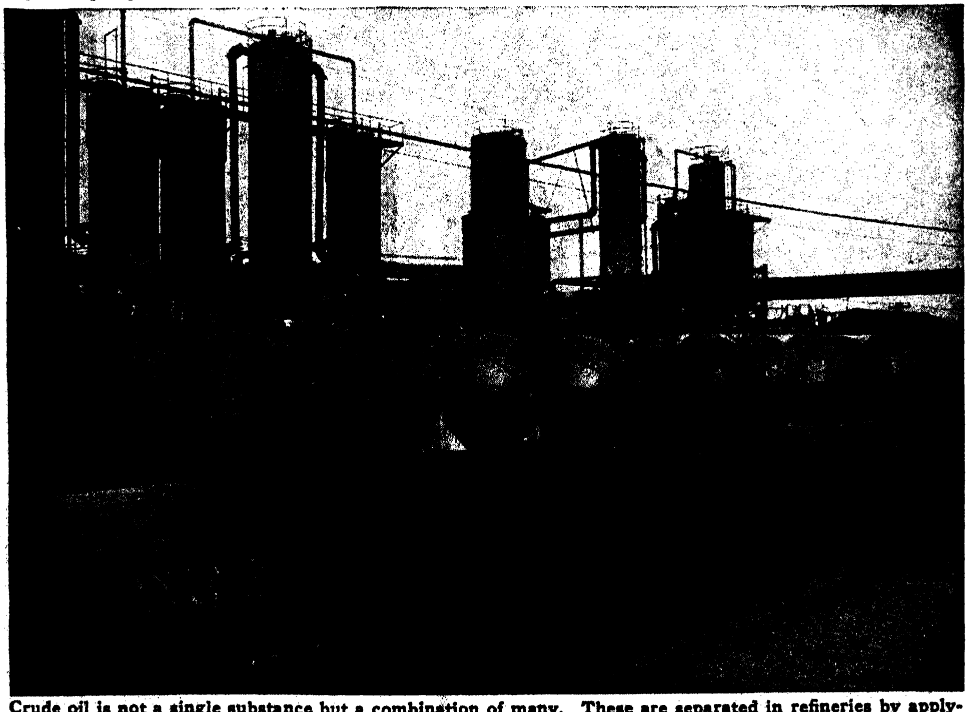
Up to the present time all the oil produced in the United States has come from wells; and people have feared that before very long the supply would be exhausted. These fears, however, have been proved needless. There are vast quantities of oil-bearing shale rocks in a number of the states, and geologists say that from these shales enough oil will come to supply all the wants of many generations.

THE NEXT STORY OF THE UNITED STATES IS ON PAGE 4463.

FROM THE OIL WELLS TO THE REFINERY



This corner of a Middle Western oil field shows the high derricks, like narrow pyramids. These are built first to operate the drills which drive the well deep down through earth or rock, and are retained as a part of the pumping apparatus. Some wells send a stream of oil high into the air, but deep wells usually require a pump to bring it to the surface. The tanks hold the oil until it is sent away.



Crude oil is not a single substance but a combination of many. These are separated in refineries by applying different degrees of heat. Low heat turns the lighter parts to vapor, which becomes liquid again in a condenser. This is a naphtha still. This word is sometimes used to mean a particular oil, and sometimes to include naphtha itself mixed with still lighter oils. See the tank cars on the railway in the foreground.

Part of a frieze on the Temple of Apollo, near Phigalæia, in Arcadia, built in the year 470 B.C.

A LITTLE TALK ON SCULPTURE

CONTINUED FROM 4153

WHEN we hear people talk about art and artists, we in America at once think of pictures and painters, because in America there are many more pictures than sculptures. But art also includes music, architecture, decoration of houses, and what is perhaps the highest and noblest of all—sculpture. Few statues are seen in England, because the climate is cold and rainy and foggy, and statues in marble would not look well under these conditions. In Italy and France, where the sun is warmer, and fog and rain are comparatively rare, they have much sculpture, both in marble and in bronze.

To understand exactly what sculpture is, and what is good and what is bad, we must know what is meant by a statue, a relief, a bust, and a panel. And this is easily told.

A statue, as we all know, is a sculptured or carved figure of a human being or an animal. Statues may be life-size, larger than life, or smaller. When they are very small they are called statuettes. When they are much larger than life they are called heroic.

A bust is just the head and shoulders. A relief is a sculptured or carved figure, or several figures, or flowers, or anything else, on a background or slab. If we should see the Nelson column in Trafalgar Square, we shall notice that there are sculptured pictures at the sides of the base. These are reliefs—*high* reliefs, because they stand out boldly. If we see a relief that does not throw much shadow, we shall know it is a *low* relief. Panels are reliefs set in frames. The art of sculpture is very, very old. Even in the far-off days of Pharaoh even before the days of which we read in the Bible, there was sculpture.

The oldest important piece of sculpture that we know is the great Sphinx, a huge lion with a woman's head, half buried in the desert sand near the Pyramids in Egypt. The Egyptian sculpture was very simple and primitive, but at the same time refined and beautiful. In sculpture the Egyptians and Assyrians were the forerunners of the Greeks. That is to say, the Greeks followed the Egyptians in respect of time—in fact, the Greeks were at their best long after the Egyptians had done their best work.

Before the history of Egypt began, before the first dynasty, or family of kings, the prehistoric inhabitants carved figures, statues and heads, and many reliefs which, though crude, are good enough to show us that they must have been practising sculpture for a very long time before. Some of these very early works are in our great museums. The first dynasty began about 4800 B.C., and up to the end of the thirteenth

dynasty, in 342 B.C., the sculpture of Egypt advanced to a very high standard. In 331 B.C. Alexander the Great conquered the Egyptians, and from that time their sculpture grew more and more like that of the Greeks.

THE TWO SOLITARY STATUES THAT KEEP GUARD OVER THE PLAIN OF EGYPT

Two pieces of the time of Amenhotep III. are so well known that we must remember them and the king who commanded them to be set up. These are the two gigantic statues on the plain near Thebes. They are sitting with their hands upon their knees, and seem to be keeping watchful guard over the plain and the distant temples and royal tombs.

After the death of Alexander the Great, in 323 B.C., Ptolemy I. ruled; and to the end of the Ptolemaic dynasty, when the Romans came to Egypt, the art of sculpture was influenced by the Greeks. But under the Romans it gradually sank and died out, just as the people themselves ceased to play a part in history. So we can leave them and pass to other countries.

We must remember that in Assyria they had sculpture just as in Egypt, but, like that of Egypt, it had but little influence upon other nations, and gradually died out. But now we come to the Greeks—the great nation that produced the best sculpture the world has ever seen. From 1000 B.C. to about 550 B.C. it was archaic—they made statues as a child of to-day would make them—stiff and lifeless. From about 550 B.C. to 430 B.C. they developed their art and tried to make statues more like real beings. This advance was first made in Ionian Asia Minor. The Ionian merchants were very much in touch with Egypt and Babylonia, and so the art of the Ionians was somewhat influenced by these countries.

THE GREAT GREEK MASTERS AND THEIR WONDERFUL WORKS IN STONE

But Greek sculpture was also slowly advancing in Argos and Attica, where the sculptors met and saw each other's work, and so their statues became more like each other, the one sculptor adopting in his statues points that he found best in the other's work. The Greeks were very fond of athletic games, which were of such importance to them that they often made statues of the Olympic champions. One of these statues, the Discobolus, by Myron, is in the Ashmolean Museum, Oxford. It is a beautiful statue of a disk-thrower—disk-throwing being a sport of which the Greeks were very fond. Two of the very finest examples of Greek sculpture can be seen in the British Museum. One is of draped figures, the other a nude figure. The former are the Three Fates, from the Parthenon at Athens; the latter is the Theseus, from the same temple. The whole decoration of the Parthenon is the work of Phidias, the greatest of all Greek sculptors. Other great sculptors were Polycletus, Praxiteles, Scopas, and Lysippus.

Among the most famous works that have been preserved to our day are the wonderful Venus of Milo, at the Louvre in Paris, named after the island of Milo or Melos, where it was found; the Victory of Samothrace, the Doryphoros by Polycletus, and the Hermes by Praxiteles.

THE DARK AGES IN WHICH THE ART OF SCULPTURE DISAPPEARED

Greek sculpture developed and flourished up to 150 B.C., about which time the Romans, under Mummius, conquered Greece. The Romans not only carried off the finest works produced by the conquered people, but induced the best Greek artists and craftsmen to come to Italy, so that Greece ceased to produce great works, while the sculptors of the Roman Empire devoted themselves mainly to the making of portrait busts and the copying of famous Greek originals, until the art declined altogether at the time of the fall of the empire.

In the so-called "Dark Ages," sculpture was of very little account. It was believed that the end of the world would come in 1000 A.D., and we can easily understand that as this year approached everyone grew more and more alarmed, and cared very little about decorating the cities and houses. Thus sculpture died out almost entirely. Nobody wanted it, nobody practised the art. At last the year 1000 ended, and nothing had happened. People began to realize that they had been mistaken. Then, as they were able to feel more sure of this, they became very thankful to God, and grew more religious. They built many churches and cathedrals, and consequently a new demand arose for sculpture.

France was the first country to revive this art. Cathedrals were built, for instance, at Rouen, Amiens, Chartres, Bayeux, Rheims, and Bourges, and, in all these, many statues were placed. In England, also, the religious movement grew, and during the next 500 years most of the cathedrals were built.

THE FINE RELIGIOUS SCULPTURES CARVED BY THE OLD STONEMASONS

The sculptures in these buildings were not done by what we should call great sculptors, for there were none in those days. The stone-carvers were just simple tradesmen, or craftsmen, like the stonemasons. They learned their trade, or craft, from their fathers, who had learned it from their fathers before them. It was not until the time of Queen Elizabeth that sculpture really found a footing in England, and that sculptured figures and statues began to be used to any great extent.

The great movement of the Renaissance, which means *re-birth*—the re-birth of classic art and classic learning—began in Italy. The cathedral sculptors belonged to the so-called *Gothic* period, and, with all their love of beautiful detail and their deep feeling, they were often awkward and stiff, lacking in dignity and personal style.

The first great Italian sculptor was Niccola Pisano, who was born about 1206 and died in 1278. While still influenced by the Gothic carvers, he had studied the scarce examples of classic art that had come to his notice.

He had many followers, the most famous of whom were his son Giovanni, and Andrea Pisano, who lived from about 1270 to 1349, working much of the time in Florence. Now the sculptors increased in numbers, and they wished to imitate the Greeks and Romans no more, but rather, like the Greeks, to copy Nature as they found her. They made men in stone as they appeared to be in life, and they carved flowers and trees and animals just as naturally as they could.

THE MODERN MASTERS AND THEIR SPLENDID HORSEBACK SCULPTURES

In 1378, Lorenzo Ghiberti was born in Florence, and he has left in that city many beautiful works, such as the famous bronze gates of the Baptistery, that we see on page 2786. Donatello, his pupil, was born about 1386. He made even a greater name than his master, and three of his best works are the St. George and the David in Florence, and the Gattamelata in Padua, the first large equestrian, or horseback, monument of modern times. From year to year the arts of painting, architecture, and sculpture advanced. After Donatello came Jacopo della Quereia and Luca della Robbia. Luca modeled the little white babies on blue backgrounds, reproductions of which we see in the large stores. Then came Verrocchio, born in 1435, who, together with Leopardi, made the wonderful Colleoni monument in Venice, the finest equestrian statue in the world.

At last we come to the greatest of the Renaissance sculptors, Michael Angelo, born in 1475. He was a good painter, and a great architect, but his sculpture astonished all who saw it, and it remains some of the best work the world has ever seen. We can only mention his chief works here. These are: David, a colossal statue, and the Medici tombs in Florence; and Moses, and the Pietà in Rome. Benvenuto Cellini, goldsmith and sculptor, and Giovanni Bologna followed; and Bernini carried on the spirit of the Renaissance to about 1680, although the work of Bernini shows much of the exaggerated restlessness and floridness of what is now commonly known as the *baroque*, or uncouth and irregular, period.

HOW THE SCULPTORS SPOILED THEIR WORK IN TRYING TO MAKE IT BETTER

Sculpture now was on the decline. Instead of keeping their works strong and simple, the artists made them more and more elaborate and delicate. Sculpture had reached its best, and Bernini, in trying to make it better by copying every little detail, spoiled it and weakened it by not making it sufficiently simple. His bad qualities were copied and imitated and increased by the sculptors who came after; and thus the art grew worse and worse. The decline was not like that of Egypt, where sculpture was stopped and stamped out by the Roman conquest, but it simply became more tasteless, too ornate, and too extravagant.

Meanwhile, sculpture in France had progressed under Francis I., who became king in 1515. He encouraged art with great energy, and in building his palaces he employed such sculptors as Goujon,

Cousin, Pilon, and many others. Chief of them was Jean Goujon, whose Diana, now at the Louvre in Paris, is sufficient to make him famous. Pierre Puget followed, and Girardon, Falconet, and Pigalle. But we need not stay here to mention their work, for they belong to an indifferent period. It is better to begin again with the modern men, who started yet another revival of sculpture, which is still advancing.

HOW THE MODERN SCULPTORS TRIED TO REVIVE THE CLASSIC STYLE AND FAILED

Of these men, Clodion and Houdon were eminent. Though they followed and were influenced by those whom we have just mentioned, their work was simpler and more refined. After them came a period in which sculptors tried to revive, or imitate, the style of the Greeks. This attempt was made not only in France, Italy, and Belgium, but also in England, where little had been done, so far, in sculpture.

The imitation classic revival lasted roughly from 1789 to 1848. The men responsible for it were chiefly Canova in Italy, Thorwaldsen in Denmark, and Flaxman in England. Their works were cold, and did not seem to live; nor were they pleasing, because they did not look like men who lived and worked—they were simply commonplace imitations of the Greek statues, which they did not really understand. They did not know why Greek statuary was so good; and, in copying, left out all that was fine and beautiful, and thus made statues that were extremely dull and lifeless, very lumpy and heavy, and quite uninteresting.

THE SCULPTOR'S RETURN TO NATURE AND THE STATUES OF REAL PEOPLE

But now Englishmen began to think more of art. They were at first pleased and impressed with the imitation of Greek, because they thought they were making sculpture just like the ancient Greeks. Flaxman, who modeled the beautiful reliefs on Wedgwood vases and plaques, introduced the classic, or Greek, idea into England.

But soon sculptors tired of it. They wished to represent and carve, not Greek gods, but men and women of their own time. Thus they began to be more real, and to copy Nature instead of the work of men who lived in the ages before Christ. Chantrey and Gibson in England, and Dubois and Dalou in France, made this change felt; and it was further advanced by Alfred Stevens, Lord Leighton, Onslow Ford, Hamo Thornycroft, and others. Stevens's Wellington Memorial in St. Paul's Cathedral is the finest monument ever produced by a British artist. Leighton's Athlete and Python are in the Tate Gallery, together with Onslow Ford's Egyptian Singer. In the United States many men have done good work. Augustus St. Gaudens excelled in low relief and his equestrian statue of Sherman is a great work. Frederic Macmonnies' Bacchante has won much praise, and his fame is increasing as the years go by. George G. Barnard has produced some striking figures for the capitol of Pennsylvania. Several other men are hardly less important, and their number is increasing.

AUGUSTE RODIN, THE GREATEST OF MODERN SCULPTORS

The greatest of modern sculptors is, some think, the Frenchman Auguste Rodin. He is unlike any other sculptor, except, perhaps, the Belgian Constantin Meunier. While Meunier was making sculptures of working men and women, and making them look like peasants and laborers, Rodin was breaking away from the academic school — the set of sculptors who thought sculpture must be smooth and classic in pose — and was picturing, in marble and bronze, people *as he saw them.* Rodin has made his figures in natural attitudes, which was not done before, because people were used to the stiff and academic positions, such as we see in the work of the imitation classic period.

The Dock Laborer, by Meunier, is in the Luxembourg Museum in Paris, besides his Puddlers at the Furnace and The Glebe. The Kiss, by Rodin, is in the same museum; while the Pantheon, in Paris, possesses The Thinker, one of his best works. There are also some of his remarkable sculptures in London, and the Metropolitan Museum in New York owns a very fine collection of his work.

Our younger sculptors in America are doing beautiful work; and sculpture in America is now, it is safe to say, as good as any modern sculpture of other countries. These men are thinking more for themselves, and are copying old work.

THE NEXT FAMILIAR THINGS ARE ON PAGE 4241.

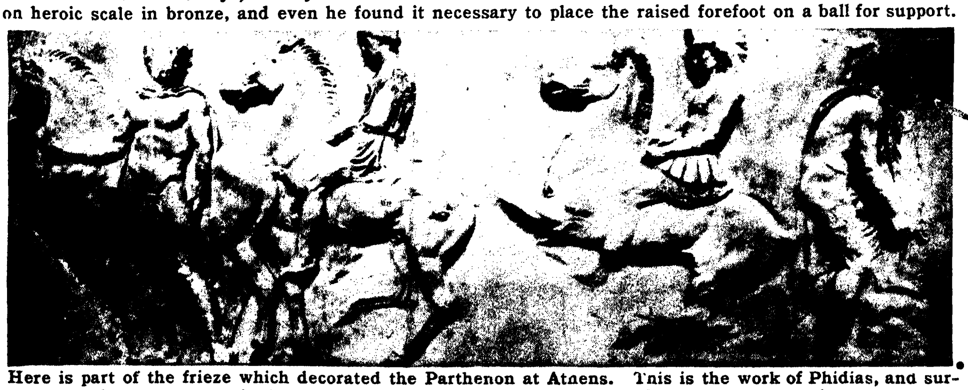
THE MIGHTY SCULPTURES OF OLD EGYPT

Here are two gigantic statues set up near Thebes in Egypt about 1400 B.C. They are the largest seated figures in the world, and are made of sandstone quarried near the Nile. One of them was called the Singing Memnon, because of the sound said to be given out by the stone when warmed by the morning sun.

The great Sphinx is the oldest colossal sculpture in the world. With a lion's body and a woman's head, it lies on the edge of the desert, carved out of a huge rock protruding from the sand. It is about five thousand years old. The mystery of this strange statue has always proved very fascinating to imaginative minds.

THE FIRST MODERN HORSEBACK STATUE

The monument of General Gattamelata on horseback, by Donatello, is the first equestrian monument of modern times. In his days, nobody but Donatello could have undertaken the difficult task of casting a horse on heroic scale in bronze, and even he found it necessary to place the raised forefoot on a ball for support.



Here is part of the frieze which decorated the Parthenon at Athens. This is the work of Phidias, and surpasses in beauty any work the world has seen. The spacing of the figures and sense of movement are marvelous. The whole design represents a long procession of mounted horsemen going to sacrifice to a god.

THE WORLD'S FINEST STATUE OF A HORSE

The monument in Venice to General Colleoni, by Verrocchio, is the noblest and most imposing equestrian monument in the world. See how proudly the bold soldier sits his horse; note the vigorous action of his arm, the defiant, commanding expression of his features, and the effect of a forward movement in the horse.

This part of the Parthenon frieze shows even more vividly than that on page 4176 the sense of movement created by the lines of the horses' legs and the drapery. A notable thing is the completion of action in the frieze. One horse raises his leg, the next horse raises his higher, and so on till the action is completed.

A WONDERFUL GROUP THAT SEEMS TO MOVE

This statue, called the Laocoon, discovered in the year 1506, is the most beautiful group of later Greek sculpture, when artists were no longer satisfied with simple figures in repose or moderate action, and tried to express violent movement and passion. It is the work of Agesander, Polydorus, and Athenodorus.

TWO OF THE WORLD'S FINEST STATUES

Donatello's St. George in Florence is perhaps the finest example of armor in sculpture. The hard and metallic appearance of the armor is softened and beautified by the clinging of the garments to the body.

The Venus of Milo, so called from the island where it was found, is the most perfect female statue in the world. The surfaces are broad and simple. The grace of outline and the modeling have never been equaled.

OLIVER CROMWELL AT WESTMINSTER

Oliver Cromwell, by Hamo Thornycroft, is a good example of modern English sculpture. Note how the artist has expressed, in the firm attitude of the short-set figure and in the resolute face, the character of the man of action. His life was determined by the Bible and the sword; and both are happily introduced.

GREAT SCULPTURES OF MODERN MASTERS

Constantin Meunier was the first sculptor to represent the working man. This example is one of his strong and exceedingly simple works. The light falls softly over the modeling; only the big forms are modeled.

This is the figure of Lorenzo de Medici on his tomb in Florence. Michael Angelo thought of splendid gestures, unlike the gestures of other statuary of his time. He made the most of beautiful muscular form.

The Citizens of Calais, by Auguste Rodin represents the men who, at the command of Edward III. of England went out of the city to his camp with ropes round their necks. There is pathos in their hopeless sorrow; anguish is portrayed in all their features, and everything is done to direct attention toward their grief.

THE HERO OF KHARTOUM IN BRONZE

General Gordon, the hero of Khartoum, is here represented in bronze by Onslow Ford. The careful work put on the elaborate trappings of the camel and the details of the uniform detract from the grandeur and impressiveness of the conception, and as a result of this minute detail the monument suffers in massive effect.

The photograph of General Gordon on this page is by Messrs. Russell; the others are by Messrs. Anderson, Beato, Neurdein, and Mansell.

THE NEXT FAMILIAR THINGS ARE ON PAGE 4241.

A BALLAD OF THE FLEET

THERE are few tales of heroism to compare with that of Sir Richard Grenville, one of the brave sailors of Queen Elizabeth's day. In August, 1591, when he was commanding the Revenge in Lord Thomas Howard's squadron, they fell in with a great Spanish fleet of fifty-three vessels off the Azores Islands in mid-Atlantic. The admiral made good his escape with five vessels, but Sir Richard Grenville refused to show flight before the hated Spaniards, and, though certain death was the prospect of his engaging their great fleet with his one little vessel, he sailed the Revenge into the thick of them and fought from three in the afternoon until next morning. So gallantly did he command his little ship that fifteen of the great Spanish men-of-war were beaten off, two of them were sunk, and two more disabled. Some two thousand Spanish sailors were killed or drowned before Sir Richard, fatally wounded, gave in. The poem is by Lord Tennyson.

THE REVENGE

CONTINUED FROM 4068

AT Flores in the Azores Sir Richard Grenville lay,
And a pinnace, like a flutter'd bird, came flying from far away:
"Spanish ships of war at sea! we have sighted fifty-three!"
Then spake Lord Thomas Howard: "'Fore God I am no coward;
But I cannot meet them here, for my ships are out of gear,
And the half my men are sick. I must fly, but follow quick,
We are six ships of the line; can we fight with fifty-three?"

Then spake Sir Richard Grenville: "I know you are no coward;
You fly them for a moment to fight with them again.
But I've ninety men and more that are lying sick ashore;
I should count myself the coward if I left them, my Lord Howard,
To these Inquisition dogs and the devildoms of Spain."

So Lord Howard passed away with five ships of war that day,
Till he melted like a cloud in the silent summer heaven;
But Sir Richard bore in hand all his sick men from the land
Very carefully and slow,
Men of Bideford and Devon,
And we laid them on the ballast down below;
For we brought them all aboard,
And they blest him in their pain, that they were not left to Spain,
To the thumbscrew and the stake, for the glory of the Lord.

He had only a hundred seamen to work the ship and to fight,
And he sailed away from Flores till the Spaniard came in sight,
With his huge sea-castles heaving upon the weather bow.
"Shall we fight or shall we fly?
Good Sir Richard, tell us now;
For to fight is but to die!
There'll be little of us left, by the time this sun be set."
And Sir Richard said again: "We be all good Englishmen;
Let us bang these dogs of Seville, the children of the devil,
For I never turned my back upon don or devil yet."

Sir Richard spoke and he laugh'd, and we roar'd a hurrah, and so
The little Revenge ran on, sheer into the heart of the foe,
With her hundred fighters on deck and her ninety sick below;
For half of their fleet to the right and half to the left were seen,
And the little Revenge ran on, thro' the long sea-lane between.
Thousands of their soldiers looked down from their decks and laugh'd,
Thousands of their seamen made mock at the mad little craft
Running on and on, till delay'd
By their mountain-like San Philip, that, of fifteen hundred tons,
And up-shadowing high above us with her yawning tiers of guns,
Took the breath from our sails and we stay'd.
And while now the great San Philip hung above us like a cloud
Whence the thunderbolt will fall
Long and loud,
Four galleons drew away
From the Spanish fleet that day,
And two upon the larboard and two upon the starboard lay,
And the battle-thunder broke from them all.

And the sun went down, and the stars came out, far over the summer sea,
But never a moment ceased the fight of the one and the fifty-three.

Ship after ship, the whole night long, their high-built galleons came,
Ship after ship, the whole night long, with her battle-thunder and flame;
Ship after ship, the whole night long, drew back with her dead and her shame,
For some were sunk, and many were shatter'd, and so could fight us no more—
God of battles, was ever a battle like this in the world before?

For he said: "Fight on! fight on!"
Tho' his vessel was all but a wreck;
And it chanced that, when half of the short summer night was gone,
With a grisly wound to be dressed, he had left the deck,
But a bullet struck him that was dressing it suddenly dead,
And himself he was wounded again, in the side and the head,
And he said: "Fight on! fight on!"

And the night went down, and the sun smiled out far over the summer sea,
And the Spanish fleet, with broken sides, lay round us, all in a ring;
But they dared not touch us again, for they feared that we still could sting,
So they watched what the end would be.
And we had not fought them in vain,
But in perilous plight were we,
Seeing forty of our poor hundred were slain,
And half of the rest of us were maim'd for life
In the crash of the cannonades and the desperate strife;
And the sick men down in the hold were most of them stark and cold,
And the pikes were all broken or bent, and the powder was all of it spent;
And the masts and the rigging were lying over the side;
But Sir Richard cried in his English pride:
"We have fought such a fight for a day and a night
As may never be fought again!
We have won great glory, my men!
And a day less or more
At sea or ashore,
We die—does it matter when?
Sink the ship, Master Gunner—sink her, split her in twain!
Fall into the hands of God, not into the hands of Spain!"

And the gunner said: "Ay, ay," but the seamen made reply:
"We have children, we have wives,
And the Lord hath spared our lives.
We will make the Spaniard promise, if we yield, to let us go;
We shall live to fight again and to strike another blow."
And the lion there lay dying, and they yielded to the foe.

And the stately Spanish men to their flagship bore him then,
Where they laid him by the mast, old Sir Richard caught at last,
And they praised him to his face with their courtly foreign grace;
But he rose upon their decks, and he cried:
"I have fought for Queen and Faith, like a valiant man and true;
I have only done my duty, as a man is bound to do;
With a joyful spirit, I, Sir Richard Grenville, die!"
And he fell upon their decks, and he died.

And they stared at the dead that had been so valiant and true,
And had holden the power and glory of Spain so cheap
That he dared her with one little ship and his English few;
Was he devil or man? He was devil for aught they knew,
But they sank his body with honour down into the deep,
And they mann'd the Revenge with a swarthier alien crew,
And away she sail'd with her loss, and long'd for her own;
When a wind from the lands they had ruin'd awoke from sleep,
And the water began to heave, and the weather to moan,
And ere ever that evening ended a great gale blew,
And a wave like the wave that is raised by an earthquake grew,
Till it smote on their hulls and their sails and their masts and their flags,
And the whole sea plunged and fell on the shot-shatter'd navy of Spain,
And the little Revenge herself went down by the island crags,
To be lost evermore in the main.

FAITH

This familiar hymn, a favorite in all churches, has been translated into twenty languages. It was written by Ray Palmer, a clergyman who died in Newark, N.J., in 1887.

My faith looks up to Thee,
Thou Lamb of Calvary,
Saviour divine!
Now hear me while I pray,
Take all my guilt away,
O let me from this day
Be wholly Thine!

May Thy rich grace impart
Strength to my fainting heart,
My zeal inspire;
As Thou hast died for me,
O may my love for Thee
Pure, warm, and changeless be,—
A living fire!

While life's dark maze I tread,
And griefs around me spread,
Be Thou my guide;
Bid darkness turn to day,
Wipe sorrow's tears away,
Nor let me ever stray
From Thee aside.

When ends life's transient dream,
When death's cold, sullen stream
Shall o'er me roll:
Blest Saviour, then, in love,
Fear and distrust remove;
O bear me safe above,
A ransomed soul!

THE BOY AND THE ANGEL

Robert Browning seeks to illustrate in this poem one of the greatest truths of life. The poor boy Theocrite, sincerely praising God each day, foolishly comes to think that God would be better pleased to be praised in the "great way" of the Pope of Rome, and so his ambition is to become the Pope. But God would as soon have the simple praise of the workman at his bench as that of the richest of magnates. So the poet imagines the angel Gabriel coming down to earth to take the place of the poor workman Theocrite, while Theocrite has climbed into the papal chair. Thus, in the end the angel shames the boy. The lesson is that, no matter what our condition of life may be, we are all free to praise God in our own way.

MORNING, evening, noon and night,
"Praise God!" sang Theocrite.

Then to his poor trade he turned,
By which the daily meal was earned.

Hard he laboured, long and well;
O'er his work the boy's curls fell.

But ever, at each period,
He stopped and sang: "Praise God!"

Then back again his curls he threw,
And cheerful turned to work anew.

Said Blaise, the listening monk: "Well done;
I doubt not thou art heard, my son:

"As well as if thy voice to-day
Were praising God the Pope's great way.

"This Easter Day, the Pope at Rome
Praises God from Peter's dome."

Said Theocrite: "Would God that I
Might praise him that great way, and die!"

Night passed, day shone,
And Theocrite was gone.

With God a day endures alway,
A thousand years are but a day.

God said in heaven: "Nor day nor night
Now brings the voice of my delight."

Then Gabriel, like a rainbow's birth,
Spread his wings and sank to earth;

Entered, in flesh, the empty cell,
Lived there, and played the craftsman well.

And morning, evening, noon and night,
Praised God in place of Theocrite.

And from a boy to youth he grew,
The man put off the stripling's hue.

The man matured and fell away
Into the season of decay;

And ever o'er the trade he bent,
And ever lived on earth content.

(He did God's will; to him, all one
If on the earth or in the sun.)

God said: "A praise is in mine ear;
There is no doubt in it, no fear:

"So sing old worlds, and so
New worlds that from my footstool go.

"Clearer loves sound other ways:
I miss my little human praise."

Then forth sprang Gabriel's wings, off fell
The flesh disguise, remained the cell.

'Twas Easter Day: he flew to Rome,
And paused above Saint Peter's dome.

In the tiring-room close by
The great outer gallery,

With his holy vestments dight,
Stood the new Pope, Theocrite;

And all his past career
Came back upon him clear,

Since when, a boy, he plied his trade,
Till on his life the sickness weighed;

And in his cell, when death drew near,
An angel in a dream brought cheer:

And rising from the sickness drear
He grew a priest, and now stood here.

To the East with praise he turned,
And on his sight the angel burned.

"I bore thee from thy craftsman's cell
And set thee here; I did not well.

"Vainly I left my angel's sphere,
Vain was thy dream of many a year.

"Thy voice's praise seemed weak; it dropped—
Creation's chorus stopped!

"Go back and praise again
The early way, while I remain.

"With that weak voice of our disdain,
Take up creation's pausing strain.

"Back to the cell and poor employ:
Become the craftsman and the boy!"

Theocrite grew old at home;
A new Pope dwelt in Peter's dome.

One vanished as the other died:
They sought God side by side.

AN EVENING HYMN

One of the most beautiful of hymns for the evening hour is the following, written by the Rev. James Drummond Burns, a Scottish minister, who was born in 1823, and died at Mentone in 1864. Samuel, of course, was one of the great prophets of Israel, and in this hymn his qualities of mind and heart are chosen as worthy of our emulation.

HUSH'D was the evening hymn,
The temple courts were dark;
The lamp was burning dim
Before the sacred ark,
When suddenly a voice divine
Rang through the silence of the shrine.

Oh, give me Samuel's ear—
The open ear, O Lord!
Alive and quick to hear
Each whisper of Thy word;
Like him to answer at Thy call,
And to obey Thee first of all.

Oh, give me Samuel's heart!
A lowly heart, that waits
When in Thy house Thou art;
Or watches at Thy gates
By day and night—a heart that still
Moves at the breathing of Thy will.

Oh, give me Samuel's mind!
A sweet, unmurm'ring faith,
Obedient and resigned
To Thee in life and death:
That I may read, with child-like eyes,
Truths that are hidden from the wise.

A NAME IN THE SAND

Hannah Flagg Gould was a very popular writer of verse in America about the middle of last century, her themes being chosen chiefly from the lowly life of her country. Her aim was always to illustrate some "moral," as she does very simply and effectively in the following little religious poem.

ALONE I walked the ocean strand;
  A pearly shell was in my hand:
I stooped and wrote upon the sand
  My name—the year—the day.
As onward from the spot I passed,
One lingering look behind I cast;
A wave came rolling high and fast,
  And washed my lines away.

And so, methought, 'twill shortly be
With every mark on earth from me:
A wave of dark oblivion's sea
  Will sweep across the place
Where I have trod the sandy shore
Of time, and been, to be no more,
Of me—my day—the name I bore,
  To leave no track nor trace.

And yet, with Him who counts the sands,
And holds the waters in His hands,
I know a lasting record stands
  Inscribed against my name,
Of all this mortal part has wrought,
Of all this thinking soul has sought,
And from these fleeting moments caught
  For glory or for shame.

THE BARON'S LAST BANQUET

Albert Gorton Greene was a minor American poet, born in 1802, whose best-known poem is here printed. In spirited verse it retells an old legend of a warrior-baron who had so long overcome his enemies that he could scarce believe his greatest enemy of all, grim Death, had laid hands on him at last, and so drank a vain defiance with his last breath.

O'ER a low couch the setting sun had thrown
  its latest ray,
Where in his last strong agony a dying warrior
  lay,
The stern old Baron Rudiger, whose frame
  had ne'er been bent
By wasting pain, till time and toil its iron
  strength had spent.

"They come around me here, and say my days
  of life are o'er,
That I shall mount my noble steed and lead
  my band no more;
They come, and to my beard they dare to
  tell me now that I,
Their own liege lord and master born—that
  I, ha, ha! must die.

"And what is Death? I've dared him oft
  before the Paynim spear—
Think ye he's entered at my gate, has come
  to seek me here?
I've met him, faced him, scorned him, when
  the fight was raging hot—
I'll try his might—I'll brave his power; defy,
  and fear him not.

"Ho! sound the tocsin from my tower, and
  fire the culverin;
Bid each retainer arm with speed, call every
  vassal in;
Up with my banner on the wall; the banquet
  board prepare;
Throw wide the portal of my hall, and bring
  my armour there!"

A hundred hands were busy then—the banquet
  forth was spread—
And rung the heavy oaken floor with many a
  martial tread,
While from the rich, dark tracery along the
  vaulted wall,
Lights gleamed on harness, plume, and spear,
  o'er the proud old Gothic hall.

Fast hurrying through the outer gate the
  mailed retainers poured,
On through the portal's frowning arch, and
  thronged around the board,
While at its head, within his dark, carved
  oaken chair of state,
Armed cap-à-pie, stern Rudiger, with girded
  falchion, sate.

"Fill every beaker up, my men, pour forth
  the cheering wine;
There's life and strength in every drop—
  thanksgiving to the vine!
Are ye all there, my vassals, true?—mine
  eyes are waxing dim;
Fill round, my tried and fearless ones, each
  goblet to the brim.

"You're there, but yet I see ye not. Draw
  forth each trusty sword,
And let me hear your faithful steel clash once
  around my board.
I hear it faintly—louder yet! What clogs my
  heavy breath?
Up all, and shout for Rudiger, 'Defiance
  unto Death!'"

Bowl rang to bowl—steel clang to steel—and
  rose a deafening cry
That made the torches flare around, and shook
  the flags on high.
"Ho, cravens, do ye fear him? Slaves,
  traitors, have ye flown?
Ho, cowards, have ye left me to meet him
  here alone?

"But I defy him—let him come!" Down
  rang the massy cup,
While from its sheath the ready blade came
  flashing half-way up;
And with the black and heavy plumes scarce
  trembling on his head,
There in his dark, carved oaken chair old
  Rudiger sat—dead!

JESUS, TENDER SHEPHERD

This beautiful little poem is really an evening prayer in rhyme, and was written many years ago by Mrs. Mary Lundie Duncan, the author of "Rhymes for My Children." She is remembered as much for her quiet, useful life as for her poetry, of which she did not publish a great deal.

JESUS, tender Shepherd, hear me,
  Bless Thy little lamb to-night;
Through the darkness be Thou near me,
  Keep me safe till morning light.

Through this day Thine hand has led me,
  And I thank Thee for Thy care;
Thou hast warmed me, clothed, and fed me,
  Listen to my evening prayer.

Let my sins be all forgiven,
  Bless the friends I love so well;
Take me, when I die, to heaven,
  Happy, there with Thee to dwell.

A WOMAN'S SHORTCOMINGS

Most of Elizabeth Barrett Browning's poems have a depth of feeling and beauty of rhythm unsurpassed by those of any other woman poet. Although almost all her poetry was written for grown-ups, still a child can enjoy it.

SHE has laughed as softly as if she sighed,
She has counted six and over,
Of a purse well filled, and a heart well tried—
Oh, each a worthy lover!
They " give her time " ; for her soul must slip
Where the world has set the grooving ;
She will lie to none with her fair red lip—
But love seeks truer loving.

She trembles her fan in sweetness dumb,
As her thoughts were beyond recalling,
With a glance for *one*, and a glance for some,
From her eyelids rising and falling.
Speaks common words with a blushful air,
Hears bold words, unreproving ;
But her silence says—what she never will swear—
And love seeks better loving.

Go, lady, lean to the night-guitar,
And drop a smile to the bringer ;
Then smile as sweetly, when he is far,
At the voice of an indoor singer.
Bask tenderly beneath tender eyes,
Glance lightly on their removing ;
And join new vows to old perjuries—
But dare not call it loving.

Unless you can think, when the song is done,
No other is soft in the rhythm ;
Unless you can feel, when left by one,
That all men else go with him ;
Unless you can know, when unpraised by his breath,
That your beauty itself wants proving ;
Unless you can swear, " For life, for death ! "—
Oh, fear to call it loving !

Unless you can muse in a crowd all day,
On the absent face that fixed you ;
Unless you can love, as angels may,
With the breadth of heaven betwixt you ;
Unless you can dream that his faith is fast,
Though behoving and unbehoving ;
Unless you can *die* when the dream is past—
Oh, never call it loving !

SUDDEN LIGHT

I HAVE been here before,
But when or how I cannot tell:
I know the grass beyond the door,
The sweet keen smell,
The sighing sound, the lights around the shore.

You have been mine before,—
How long ago I may not know :
But just when at that swallow's soar
Your neck turn'd so,
Some veil did fall,—I knew it all of yore.

Has this been thus before ?
And shall not thus time's eddying flight
Still with our lives our love restore
In death's despite,
And day and night yield one delight once more ?

D. G. ROSSETTI.

THE MOUSE AND THE CAKE

Already we have read several poems by Eliza Cook, notable in her day as a writer of popular verse of a pure and elevating character. In the following poem from her pen, we have one of the most familiar type of fables, the " moral " of which is so plain that not even the youngest will need to have it pointed out. It is, however, a moral not readily accepted either by old or young, and for that reason there is perhaps good need to keep the little poem in circulation

A MOUSE found a beautiful piece of plum-cake,
The richest and sweetest that mortal could make ;
'Twas heavy with citron and fragrant with spice,
And covered with sugar all sparkling as ice.

" My stars ! " cried the mouse, while his eye beamed with glee,
" Here's a treasure I've found ! What a feast it will be !
But hark ! there's a noise ! 'Tis my brothers at play ;
So I'll hide with the cake, lest they wander this way.

" Not a bit shall they have, for I know I can eat
Every morsel myself, and I'll have such a treat ! "
So off went the mouse, as he held the cake fast ;
While his hungry young brothers went scampering past.

He nibbled and nibbled, and panted ; but still
He kept gulping it down till he made himself ill ;
Yet he swallowed it all, and, 'tis easy to guess,
He was soon so unwell that he groaned with distress.

His family heard him, and as he grew worse,
They sent for the doctor, who made him rehearse
How he'd eaten the cake to the very last crumb,
Without giving his playmates and relatives some.

" Ah me ! " cried the doctor, " advice is too late ;
You must die before long, so prepare for your fate.
If you had but divided the cake with your brothers,
'Twould have done you no harm, and been good for the others.

" Had you shared it, the treat would have been wholesome enough ;
But eaten by *one*, it was dangerous stuff ;
So prepare for the worst." And the word had scarce fled,
When the doctor turned round, and the patient was dead.

Now all little people the lesson may take,
And *some* large ones may learn from the mouse and the cake,
Not to be over-selfish with what we may gain,
Or the best of our pleasures may turn into pain.

THE ARROW AND THE SONG

In these famous verses by Henry W. Longfellow, the poet's object is to illustrate a great truth, which, if we but bear it in mind, will very seriously affect our life and conduct. Nothing that we do, nothing that we think or say, though at the time we may not guess the consequence, is done in vain. Just as the arrow shot in the air will somewhere fall to earth, so the deeds we do and the thoughts we express will make their marks perhaps on the lives of others, unseen by us, and will unconsciously affect our own lives as well.

I SHOT an arrow into the air,
  It fell to earth, I knew not where;
For, so swiftly it flew, the sight
Could not follow it in its flight.

I breathed a song into the air,
It fell to earth, I knew not where;
For who has sight so keen and strong
That it can follow the flight of song?

Long, long afterward, in an oak
I found the arrow, still unbroke;
And the song, from beginning to end,
I found again in the heart of a friend.

BIRDS IN SUMMER

The following is another of the poetical pieces by Mary Howitt, which were very widely read a generation or more ago. Although it does not rank high as poetry, there is a bright truthfulness in its effort to picture the winged freedom of the birds, and it is certainly worthy of being included in our book. It may be interesting to add that the verses are sometimes attributed to Mrs. Hemans, but we think it is much more probable that they were written by Mrs. Howitt.

HOW pleasant the life of a bird must be,
  Flitting about in each leafy tree;
In the leafy trees, so broad and tall,
Like a green and beautiful palace-hall,
With its airy chambers, light and boon,
That open to sun, and stars, and moon;
That open unto the bright blue sky,
And the frolicsome winds as they wander by!

They have left their nests on the forest-bough,
Those homes of delight they need not now;
And the young and the old they wander out,
And traverse their green world round about,
And hark! at the top of this leafy hall,
How one to the other in love they call:
"Come up! Come up!" they seem to say,
"Where the topmost twigs in the breezes sway.

"Come up, come up! for the world is fair
Where the merry leaves dance in the summer air."
And the birds below give back the cry:
"We come, we come to the branches high."
How pleasant the lives of the birds must be,
Living in love in a leafy tree!
And, away through the air, what joy to go;
And to look on the green, bright earth below!

How pleasant the life of a bird must be,
Skimming about on the breezy sea,
Cresting the billows like silvery foam,
Then wheeling away to its cliff-built home!
What joy it must be to sail, upborne
By a strong, free wing, through the rosy morn;
To meet the young sun face to face,
And pierce like a shaft the boundless space;
To pass through the bowers of the silver cloud;
To sing in the thunder-halls aloud;
To spread out the wings for a wild, free flight
With the upper cloud-winds—oh, what delight!
Oh, what would I give, like a bird, to go,
Right on through the arch of the sunlit bow,
And see how the water-drops are kissed
Into green and yellow and amethyst!

How pleasant the life of a bird must be,
Wherever it listeth there to flee;
To go, when a joyful fancy calls,
Dashing adown 'mong the waterfalls;
Then to wheel about with their mates at play,
Above and below and among the spray,
Hither and thither, with screams as wild
As the laughing mirth of a rosy child!

What joy it must be, like a living breeze,
To flutter about 'mid the flowering trees;
Lightly to soar, and to see beneath
The wastes of the blossoming purple heath,
And the yellow furze, like fields of gold,
That gladdened some fairy region old!
On mountain-tops, on the billowy sea,
On the leafy stems of the forest-tree,
How pleasant the life of a bird must be!

COMMON THINGS

We have had many poems in our book which might have had this heading. The praise of common things, the romance and beauty that dwell in them, and how they may be favorably contrasted with the rich and rare things for which we so often vainly sigh, are very frequent themes with the poets of all lands. These verses, by Mrs. Hawkshawe, do not rank high as poetry, but their good sense is indisputable.

THE sun is a glorious thing,
  That comes alike to all;
Lighting the peasant's lowly cot,
  The noble's painted hall.

The moonlight is a gentle thing,
  It through the window gleams
Upon the snowy pillow where
  The happy infant dreams.

It shines upon the fisher's boat,
  Out on the lovely sea;
Or where the little lambkins lie,
  Beneath the old oak-tree.

The dewdrops on the summer morn,
  Sparkle upon the grass;
The village children brush them off,
  That through the meadow pass.

There are no gems in monarch's crowns
  More beautiful than they;
And yet we scarcely notice them,
  But tread them off in play.

Poor robin on the pear-tree sings,
  Beside the cottage door;
The heath-flower fills the air with sweets
  Upon the pathless moor.

There are as many lovely things,
  As many pleasant tones,
For those who sit by cottage hearths
  As those who sit on thrones!

LITTLE VERSES FOR VERY LITTLE PEOPLE

TIT-TAT-TOE,
My first go,
Three jolly butcher-boys
All in a row;
Stick one up,
Stick one down,
Stick one in the old man's crown.

THOMAS À TATTAMUS took two T's
To tie two tups to two tall trees,
To frighten the terrible Thomas à Tattamus!
Tell me how many T's there are in all that.

I HAD a little boy,
And called him Blue Bell;
Gave him a little work,
He did it very well.

I bade him go upstairs
To bring me a gold pin;
In coal-scuttle fell he,
Up to his little chin.

He went to the garden
To pick a little sage;
He tumbled on his nose,
And fell into a rage.

He went to the cellar
To draw a little beer;
And quickly did return
To say there was none there.

BIRDS of a feather flock together,
And so will pigs and swine;
Rats and mice will have their choice,
And so will I have mine.

THERE was a little man,
Who wooed a little maid;
And he said: "Little maid, will you wed, wed, wed?
I have little more to say,
So will you ay or nay?
For the least said is soonest men-ded, ded, ded."

Then the little maid replied:
"Should I be your little bride,
Pray what must we have for to eat, eat, eat?
Will the flame that you're so rich in
Light a fire in the kitchen?
Or the little God of Love turn the spit, spit, spit?"

GO to bed first,
A golden purse;
Go to bed second,
A golden pheasant;
Go to bed third,
A golden bird.

THERE was an old man,
And he had a calf,
And that's half;
He took him out of the stall,
And put him on the wall,
And that's all.

HANDY PANDY, Jack-a-Dandy,
Loves plum-cake and sugar-candy;
He bought some at a grocer's shop,
And out he came, hop, hop, hop.

NURSERY RHYMES OF CHILDREN OF FRANCE

EVERY country has its own nursery rhymes, for little folks must be amused with merry or quaint verses, though they are English, French, or German. And nursery rhymes are very much alike all the world over, so far as their ideas are concerned, even if their words look like none we have ever seen in print or heard before. Here are three pretty nursery rhymes in French, with English versions of the same. So many boys and girls know French that many of our readers may be able to understand the rhymes in the original language; but it is not easy to turn the French rhymes into English rhymes, and preserve the original meaning, but this has been done very cleverly in those here printed.

LA BERGÈRE

IL était une bergère
Et ron, ron, ron, petit patapon.
Il était une bergère
Qui gardait ses moutons,
Ron, ron,
Qui gardait ses moutons.

Elle fit un fromage
Et ron, ron, ron, petit patapon.
Elle fit un fromage
Du lait de ses moutons
Ron, ron,
Du lait de ses moutons.

Le chat qui la regarde
Et ron, ron, ron, petit patapon.
Le chat qui la regarde
D'un petit air fripon
Ron, ron,
D'un petit air fripon.

Si tu y mets la patte
Et ron, ron, ron, petit patapon.
Si tu y mets la patte
Tu auras du bâton,
Ron, ron,
Tu auras du bâton.

Il n'y mit pas la patte,
Et ron, ron, ron, petit patapon.
Il n'y mit pas la patte
Il y mit le menton,
Ron, ron,
Il y mit le menton!

THE SHEPHERDESS

A DAINTY shepherd maiden,
And cheep, cheep, cheep, little patapeep.
A dainty shepherd maiden
Was watching by her sheep,
Cheep, cheep,
Was watching by her sheep.

She made a lovely cheese once,
And cheep, cheep, cheep, little patapeep.
She made a lovely cheese once
Of milk from her kind sheep,
Cheep, cheep.
Of milk from her kind sheep.

Her cat looks up demurely,
And cheep, cheep, cheep, little patapeep.
Her cat looks up demurely,
Then quick pretends to sleep,
Cheep, cheep,
Then quick pretends to sleep.

Don't dare put in your paw, Puss,
And cheep, cheep, cheep, little patapeep,
Don't dare put in your paw, Puss,
Or you'll not be let off cheap,
Cheep, cheep,
Or you'll not be let off cheap.

Good Pussy kept her paw out,
And cheep, cheep, cheep, little patapeep.
Good Pussy kept her paw out,
But dipped her chin in deep,
Cheep, cheep,
But dipped her chin in deep.

RAMÈNE TES MOUTONS

LA plus aimable à mon gré
Je vais vous la présenter.
Nous lui ferons passer barrière.
" Ramène tes moutons, bergère;
Ramène, ramène, ramène, donc,
Tes moutons à la maison."

BRING BACK YOUR SHEEP

I'LL introduce—just wait awhile—
A charming maiden by yon stile.
" Ho! pass this way," aloud we'll mock;
" Shepherdess, lead back your flock;
Lead back, lead back, as you are told,
Your pretty sheep within the fold."

LES PETITS BATEAUX

" PAPA, les petits bateaux,
Qui vont sur l'eau,
Ont-ils des jambes?"
" Mais oui, petit bêta,
S'ils n'en avaient pas.
Ils ne marcheraient pas!"

THE LITTLE BOAT

" DAD, has a boat,
Sailing afloat,
Got two legs like me?"
" Yes, little zany,
If it hadn't any,
It couldn't move, you see!"

THE MAN WHO LOVED CHILDREN

CONTINUED FROM 4091

SCHOOL is a very bright and pleasant place in these days, and boys and girls are happy when they are at school; but this was not always the case. A hundred years ago most schools were dull and gloomy, and there was no attempt to make the lessons so bright and interesting that children would look forward to them.

But here and there was a man who believed that lessons could be given in such a pleasant way that boys and girls would really love to be at school. One of these men was a Swiss named John Pestalozzi, and we all owe a great deal to him and to the way in which he gave his time and money and whole life for the great purpose he had at heart.

Pestalozzi loved children, and when he saw the misery in which most of the poor boys and girls of his native land lived, he determined to do something to help them to grow up good and useful men and women. He bought a farm, built a large dwelling-house, collected fifty of the very poorest boys he could find in the roads and lanes, and took them to live with him in his house, and taught them farming.

But Pestalozzi was not a very clever business man, and at the end of five years he had spent all his own and his wife's money in helping others, and had to give up the farm. But he had done a great deal for boys and girls, for he had shown that very poor children could be educated and trained to work, and though his own school failed, industrial schools similar to his are now found in every country. But it was not only his money that Pestalozzi gave freely to help boys and girls—he gave his whole life up to them. In 1798 the French army acted very cruelly in the canton of Unterwalden, and many poor children lost their parents. Pestalozzi at once left his family, and, gathering eighty of the poorest children into an old convent, taught them, played with them, and did everything he could to make their lives happy.

From morning to evening he was alone with them; everything they needed was provided by his hand; every help in time of need and all their teaching came from him. "My hand lay on their hand," he tells us, "my eye rested on their eye, my tears flowed with theirs, and my laughter accompanied theirs. They were with me and I was with them. Their soup was mine, their drink was mine. I had nothing—no housekeeper, no friend, no servants around me; I had them alone. Were they well, I stood in their midst; were they ill, I was at their side. I slept in the

middle of them. I was the last who went to bed at night, the first to rise in the morning. Even in bed I prayed and taught with them until they were asleep—they wished it to be so."

The picture on page 4191 shows how Pestalozzi gave himself up to the children, and how they loved him. But his life was full of disappointments, and after a year the convent was wanted by the French troops for a hospital, and the school was again broken up. Pestalozzi's life of love and self-denial was not lost. His work lives to-day in the many industrial schools for the poor, where boys and girls are taught useful trades that will fit them for the battle of life, and his labors are still bearing fruit in the better and more natural methods of teaching which are now found in every civilized country in the world.

THE BOY WHO SAVED THE BOAT

A BRITISH warship, the Seringapatam, was anchored one August afternoon off Antigua, one of the Leeward Islands of the West Indies. The weather was fine and the sea calm, and so some of the officers thought a little cruise in the pinnace to a bay two miles distant would be a nice excursion.

The plan was carried out, and a pleasant afternoon was spent. All went well on the return voyage until the wind died down and becalmed the pinnace.

Then suddenly, without any warning, a hurricane burst forth with all the fury known in the West Indian Seas. A gust of wind overturned the boat, and all on board were thrown into the raging sea.

One by one they managed to swim to the gunwale of the overturned boat and cling to the sides. Their position was dangerous, as the boat was slowly drifting out to sea. Any moment the storm might break in all its severity; and worse than all that were the dreaded sharks in the waters around.

Among the officers was a brave young midshipman, named Smith, who astonished his companions by declaring that he would swim ashore to get help.

"What!" they cried. "Swim two miles in this sea, with sharks all around?"

"Yes," he persisted. "There is no other chance. Will one of you go with me? I believe I can do it."

But the men kept silence.

Then Smith's fellow midshipman, Palmer, not to be outdone in bravery, and unwilling to let his friend risk his life alone, though he was not a very rapid swimmer, and far from strong, said that he would make the attempt.

So the two boys cast off their shoes, caps, and jackets, and, taking leave of their companions, plunged into the sea and struck out for the shore.

At first they made good progress, but soon it was apparent to the men watching them that Smith was making greater headway than Palmer. All the time Smith was on the look-out for sharks, and at last, down in the deep clear water below him, he saw two particularly large ones swimming along.

When the boys had covered about half the distance, Palmer, whose strokes had been getting weaker, called out:

"I'm done. Go on, Smith."

But Smith was not the boy to desert a plucky friend; instead, he urged him to rest an arm on his shoulder awhile.

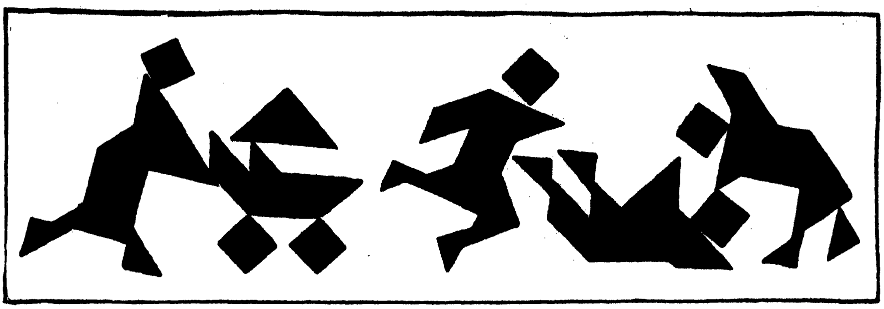
This Palmer did, and so got relief, though both boys continued to use their feet, lest the sharks should be after them. These creatures were plainly visible now, but, possibly because the boys wore dark suits and continued moving all the time, they were not attacked. The stronger boy did all he could to keep up the spirits and strength of his friend, who was by this time almost exhausted.

The last few yards were very difficult, but just in time, and after swimming for two hours, Smith felt ground under his feet, and dragged his helpless companion up on to the beach.

They were safe, but there were the men in the boat still to be rescued. Smith ran to the nearest village and two boats were manned and sent out, but by this time it was nearly dark and rain fell in torrents, so that hours were spent in searching for the overturned pinnace. Boats were also launched from the Seringapatam to find it, and at last it was discovered six miles away.

The two brave boys were presented with silver medals by the Royal Humane Society, and some time after Smith gained another medal for rescuing two men who fell overboard.

THE NEXT GOLDEN DEEDS ARE ON PAGE 4357.

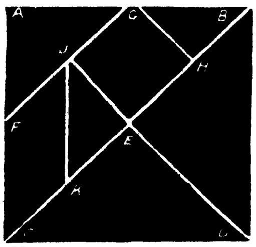


THE LITTLE BLACK TANGRAMS

CONTINUED FROM 4047

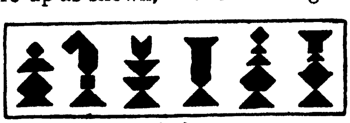
TANGRAMS are little black cards of various shapes that are supposed to have been first designed in China many centuries ago. Any boy or girl can make a set of tangrams by taking a square of black card and cutting it up into seven pieces as shown in the picture on this page.

Cardboard that is black on both sides can be bought at most stationers', but if there is any difficulty we can ourselves make the card black by coloring it with ink, or by pasting over ordinary white card a piece of black paper. It is not absolutely essential that the card should be black; any other dark color does fairly well, although it must be acknowledged that black is really best for the purpose for which tangrams are used—it shows up so well.



How to cut the tangrams.

To cut the tangrams, we take a square of card, and this may be of any serviceable size—say, three inches square. We cut, with a sharp penknife, from C to B. Then we find the middle point of C B, which is E, and cut from E to D. The remaining pieces are easily cut to the right sizes, for the various points to and from which we cut are all the middle points of lines. Thus, G is the middle of A B, F of A C, J of F G, K of C E, H of E B. Having cut the square up as shown, we have seven pieces of card of varying size—two large triangles, two small, one of medium size, a square, and a rhomboid, F C K J. The card should be black on both sides, so that this latter piece may be used on either of its sides.



Chessmen made from tangrams.

By putting these seven pieces of card together, there is scarcely anything that we cannot make with the little black tangrams. It must be understood that in each picture every one of the seven pieces of card has to be used; and we must let the whole of each piece of card be completely seen—that is, we must not put one piece partly over another. That pictures of thousands of objects, in fact, of anything, can be made with these seven little pieces of card seems impossible, but it is a fact. Take, for instance, the picture at the top of this page, showing children at play.

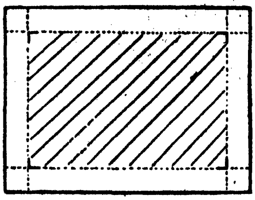
Each individual in the group is made up from one set of tangrams, and the baby-carriage is also made up from one set, so that the whole group of four children and the baby-carriage can be made out of five sets of tangrams, one set being used complete for each figure. Then, again, in the picture of chessmen, each particular chessman is made of one complete set of tangrams. These are only a few examples of what can be done with the tangrams. We can make men, animals, birds, fishes, flowers, boats, houses, shoes, lanterns, faces, geometrical figures, and so on. It is not always easy, even with a finished tangram picture in front of us as a pattern, to put the tangrams together properly to produce the picture, and we may try it with the examples given in this page. Every one of these can be made up exactly from a set of tangrams.

Even artists have declared it quite impossible to form certain figures and objects out of tangrams, and when they have afterwards been shown how these can be made up, they have expressed great wonder at the possibilities in tangrams. Even the letters of the alphabet can be made quite well, a complete set being used for each letter. With a few sets of tangram cards, endless fun and amusement, together with healthy intellectual exercise, can be obtained, and the more one uses these cards for picture-building, the more fascinating they seem to be. To entertain a company, we should supply each person with a number of sets of tangrams and award a prize to the one whose picture is decided to be the best.

PICTURE-FRAMES FOR THE SCHOOLROOM

WE are going to learn how to make frames for little pictures or photographs, so that we can hang them up and become the possessor of a small picture-gallery of our very own.

It often happens that we have a dear little picture on a Christmas card or on a picture postcard, or a snap-shot of a friend, that we should like to keep. But we cannot possibly manage a frame out of our pocket-money, and so the poor little picture has to stay on the mantelpiece till its corners are curled up and the front becomes soiled and dirty. Picture 3 on this page shows a little frame just suitable for such a purpose, and quite easy to make.



1. The mount.

These are the things we shall need :

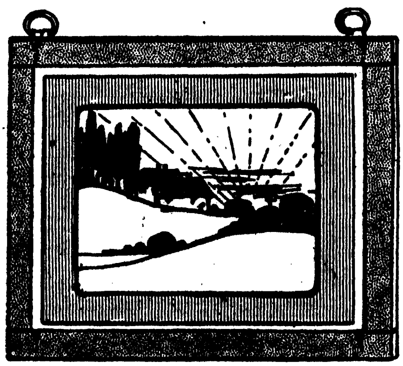
1. A few old photographic plates or squares of glass. A box of honey usually has glass sides which are about the right size for your purpose.

2. A piece of inch-wide black tape, and a piece of the narrowest width as well, both of these costing two cents.

3. One dozen small brass rings, costing five cents. We should buy a very small size—just a little larger round than a black lead pencil.

4. Some strong paste. The kind called "Library Paste" is by far the best, because it is not at all sticky to use and yet fastens things such as paper and cardboard exceedingly tightly.

5. Some white paper, a pencil, ruler, ink, and penknife.



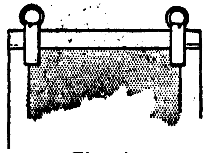
3. Picture on brown paper, with white mount.

Now we can make a start. We must take two old plates of the same size and wash off the film—that is, the jelly-like substance on one side of the glass on which the actual photograph has been taken. If we use *warm* water it will slide off the glass at once, leaving it quite clear and clean. We must polish the glass with a duster, and then, when there is not even the least little smear left, the glasses are ready for use.

Now we must find our little picture and cut it to fit the size of our plate, or it can be a little smaller. The two pieces of glass are going to form the front and back of our picture ; the picture itself will go in between, and the black tape is going to make the frame to hold it all together. The *mount* makes a border round the picture, and is also useful for filling in the space if the picture should happen to be a very small one.

We must take our little picture and put a small dab of paste on each corner at the back ; lay it on one of the pieces of glass and press it down. Then we put a book on top for a little while to keep it flat.

The next thing to do is to make a mount —that is, the little border which shows in between a picture and its frame. For this we cut a piece of white or cream paper the same size as our glass ; cartridge drawing-paper at two cents a large sheet is the best. This is easily done by laying the glass on the paper, marking round the edges with a pencil, and cutting out along the lines with scissors or a penknife. We place this paper on the table and carefully rule, in faint pencil-lines, a small border all round, about three-quarters of an inch away from the edge. This leaves a square in the middle ; we cut this out very carefully with a penknife and ruler, and we have then got our mount ready to lay over the picture which is stuck to the glass.



2. The rings.

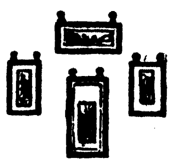
If we look at picture 1, this will be quite clear. We fix the mount to the picture in the same way, by small dabs of paste, and then lay the other glass on top of all. This must be kept in place, too, by paste, but we must be very careful to keep the paste near the edges, so that it will not show when the frame comes on.

The frame is put on next. For this we must cut four pieces of tape, each a little longer than the sides of the glass we are using, cover one side of the tape with paste, and then stick the tape on evenly all round the edge of the two glasses, letting half the width show in front.

We must be quite sure to put the top and bottom on first, and then cut off quite evenly the pieces which are left sticking out. We must put the sides on afterwards, then cut off the extra tape, and smooth down the edges with a little paste, pressed on firmly with the finger.

When the four sides are on, we should put the frame under the book again to press for an hour or so, and then fix on the rings by which it is hung up.

Through each ring we pass a piece of the narrow tape, about two inches long. We then paste the two ends firmly behind the picture, as shown in picture 2, and the frame is complete.



4. How to arrange the pictures.

When we have mastered these directions, we shall be able to make more elaborate mounts, because the picture can be improved by the kind of mount we put round it. Brown paper makes nice mounts to photographs, particularly if decorated with a black ink border. Picture 4 shows how the frames may be arranged on the wall.

HOW TO KEEP A SECRET IN WRITING

It is a wise and safe rule that if you want to keep a secret you must never write it down; but it is easy to write a secret so that nobody but yourself or your friend can read it.

Not many years ago, when a terrible thing happened in Russia, the Russian Government did not want the news of it to reach other countries, and they stopped all telegrams about it. But a clever journalist knew how to beat the Government, and he sent long telegrams to a merchant in Liverpool all about corn. It seemed very uninteresting and unimportant to the telegraph clerks in Russia, but when the merchant received the telegrams in Liverpool he knew that the Emperor of Russia was dead. The journalist had written his telegrams in a mystery-language which he and the merchant understood. You may make a mystery-language of your own. You have read of codes, and messages, and secret ciphers in times of war. A cipher is a way of writing, in any language, in such a way that even those who know the language cannot understand the writing unless they have the key which makes it clear. There are many simple ciphers which we can quickly learn; those used in time of war are, of course, very difficult.

This sentence would puzzle some boys and girls if they saw it in a book: "Ihopeyoucanreadthis," but it is really only six words joined together.

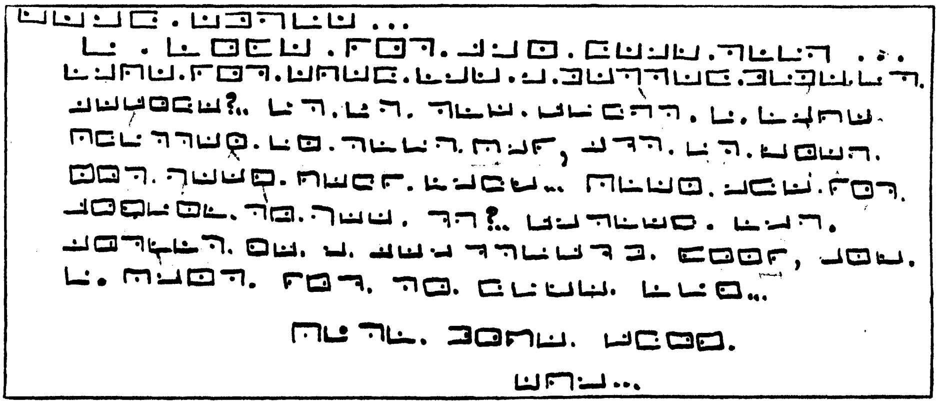
That is the simplest kind of cipher you can have, and of course it is not really a cipher at all. Here are some others, three letters written in different ciphers. The first looks like a Chinese puzzle, but the key will show you how easy it is.

Extraordinary as this seems, it is really very simple when you have the key to the cipher in which the letter is written. The alphabet is divided up so that it is possible to indicate the position of any one letter by a dot, as is seen here:

a b c	d e f	g h i
j k l	m n o	p q r
s t u	v w x	y z

You will notice that there are three letters of the alphabet in each space, except the last. To write the key, begin with the first letter in the first space, then write the alphabet *across* the rows of spaces. Next you must notice the position of each letter in each space; for instance, *a* is the *first* letter in the space marked by the lines ⌋. Thus, instead of writing *a*, you write .⌋, being careful to place the dot in the *first position* in the space. In the same way *b* is written .⌋, where the dot is in the *second position*. The letter *d* is the first dot in the second space, thus: |. |, *e* is | . |, and so on for the remainder of the letters. Instead of using dots the figures 1, 2, 3 may mark positions, so that *a* would be 1⌋, *b* 2⌋, *c* 3⌋, and so on; but the dot system is better and more puzzling. When writing a letter in this way, remember to *put a full stop after each word* and *three stops at the end of each sentence.* Always take care that these stops come *outside* the space. The comma and other marks may be used as usual.

Now that you have the key you will be able to read the cipher letter which says:



Dear Elsie,

I hope you can read this. Have you ever had a letter like it before? It is the first I have written in this way, but it does not seem very hard. When are you coming to see us? Father has bought me a beautiful pony, and I want you to ride him. With love from Eva.

Here is another cipher—a letter in figures:

13.2.1.43— 2.51.1—
45.23.2— 21.3.43.44.45— 41.1.43.45—
4.21— 54.4.5.43— 33.2.45.45.2.43—
45.4.4.32— 34.2— 1— 33.4.35.22—
45.3.34.2— 45.4— 43.2.1.13, 11.5.45— 3—
44.4.4.35— 11.2.22.1.35— 45.4—
32.35.4.52— 45.23.2— 33.2.45.45.2.43.44—
52.3.45.23.4.5.45— 5.44.3.35.22—
45.23.2— 32.2.54... 3— 1.34—
12.4.34.3.35.22— 45.4— 44.2.2— 54.4.5—
3.35— 45.23.2— 23.4.33.3.13.1.54.44—
3.21— 3— 12.1.35...
52.3.45.23— 33.4.51.2— 21.43.4.34—
2.33.44.3.2.

To get the key of this cipher write out the alphabet in this way, numbering the five vowels in order:

a b c d e f g h i j k l m n o p q r s t u v w x y z.
1 2 3 4 5

Thus, a is 1; e is 2; i is 3; o is 4; u is 5.

To find any other letter, we must get first the number of the vowel before it, then count the number of letters after the vowel until we reach the letter we want. Thus, *b* comes after the *first* vowel, and is the first letter after it; and instead of *b* we write 11—the first figure for the number of the vowel, the second for the number of the letter past the vowel. In the same way, *c* is 12—that is, the second letter past the first vowel; *f* is 21—that is, the first letter after the second vowel. We must be very careful, of course, to put the number of the vowel in its proper place.

We can now write the whole alphabet in figures according to our cipher:

a, 1	e, 2	i, 3	m, 34	q, 42	u, 5	x, 53
b, 11	f, 21	j, 31	n, 35	r, 43	v, 51	y, 54
c, 12	g, 22	k, 32	o, 4	s, 44	w, 52	z, 55
d, 13	h, 23	l, 33	p, 41	t, 45		

In writing this cipher, *put a full stop after each letter*, and *a short line at the end of each word*. Finish a sentence with three full stops; use commas and other stops as usual. You will now be able to read the figure-letter in ordinary writing. Here it is:

DEAR EVA,

The first part of your letter took me a long time to read, but I soon began to know the letters without using the key. I am coming to see you in the holidays if I can. With love from ELSIE.

The third cipher may seem more puzzling still at first sight, though it has a great drawback which may often destroy its value.

DEEEEAYARE EEELLESSEYEEE,

Doubleyouee aitchaydee essyousea-aitch effyouen ohveeeeare teaaitchee elleeteateaeeare wyohyou esseeentea. Jayayseakay teaaitcheyeenkayess wyohyouare seaeyepeaaitcheeare eyeess veeeearewy geeohohdee. Eye ayem jayyouesstea geeoheyeengee ohyoutea ohen emwy peaohenwy, essoh geeohohdee-bewyee.

Doubleyoueyeteaaitch ellohveeee effareohem EEVEEAY.

If you will read this letter aloud, the mystery will become clear to you. The secret of it is that every letter is spelled. Some letters of the alphabet can be spelled in more than one way, but it does not matter which we choose if we keep the same throughout our letter.

The key to our spelling here is:

a, ay	h, aitch	o, oh	u, you
b, be	i, eye	p, pea	v, vee
c, sea	j, jay	q, cue	w, doubleyou
d, dee	k, kay	r, are	x, ex
e, ee	l, ell	s, ess	y, wy
f, eff	m, em	t, tea	z, zed
g, gee	n, en		

In ordinary writing, the letter reads:

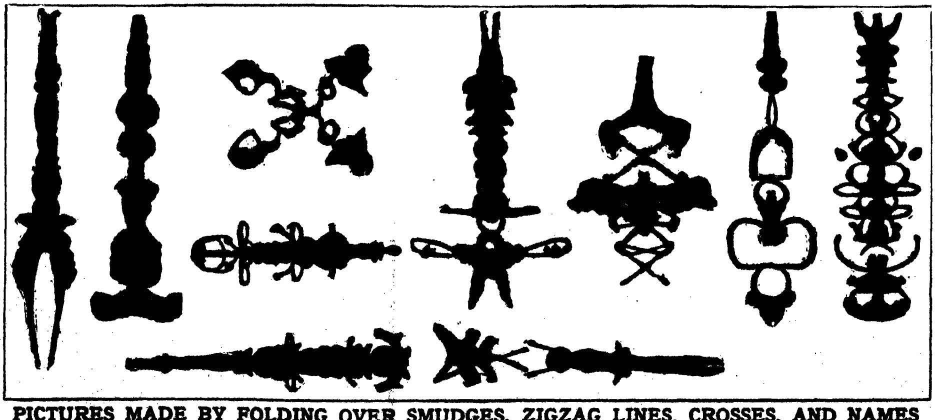
DEAR ELSIE,

We had such fun over the letter you sent. Jack thinks your cipher is very good. I am just going out on my pony, so good-bye. With love from EVA.

These examples of mystery-writing will give you great amusement if you practise them, and you will find that to invent new ciphers for yourself is very simple now that you have learned to understand these.

NAME-PICTURES AND HOW TO MAKE THEM

MAKING name-pictures, or "smudge-graphs," is a very pretty amusement. We want some paper, pens, and ink, and must sit up to the table. Dip the pen in the ink and scribble quickly a fairly thick zig-zag line on the paper; then, before it gets dry, fold the paper over at the side of the scribbled line, and rub it down with the thumbnail. On opening it again, a pretty outline will be seen. Names or words may be written instead, and the paper folded just at the base of the letters. Quite pretty ornamentations can be made like this, even by people who are not able to draw. Fold the paper *first* and use the fold to write against, as you use the lines in exercise books. Sometimes better effects are made by folding the paper through the middle of the word instead of by the side of it.



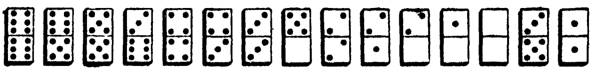
PICTURES MADE BY FOLDING OVER SMUDGES, ZIGZAG LINES, CROSSES, AND NAMES

TRICKS WITH A SET OF DOMINOES

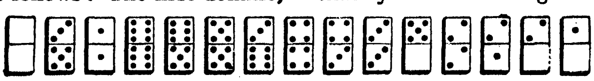
MOST of us possess a box of dominoes, but few, probably, ever thought of using them for conjuring purposes. As a matter of fact, however, a set of dominoes, in the hands of a smart boy, will enable him to perform two or three capital tricks that will cause much wonder among the audience.

To begin with, he may invite someone to pick out any domino he pleases, and after noticing its points, hold it hidden in his hand. He is then to multiply the points at either end of the domino by two, add five to the product, multiply the total so obtained by five, and add the points at the opposite end. On his stating the final result, the young wizard will tell him what domino he chose.

In order to ascertain this, all that he has got to do is to subtract twenty-five from the number given him, when the remainder will consist of two figures, corresponding with the two ends of the domino. Thus, suppose that the points were six, three. Twice 6 are 12; 12 and 5 are 17, and 5 times 17 are 85. The addition of the 3 points at the other end of the domino brings the total up to 88. This is, therefore, the number which is told to the performer. Subtracting 25 from 88, the remainder is 63, the two digits, 6—3, supplying the desired answer. Whichever end of the domino we begin with, it comes to the same thing. Suppose we begin with the 3 instead of the 6. Twice 3 are 6; 6 and 5 are 11; 5 times 11 are 55, and 55 and 6 make 61. Twenty-five taken from 61 leave 36, again giving the points of the domino, but this time in the reverse order, 3—6.


1. The row of dominoes arranged ready for the trick to be performed.

After repeating the trick once or twice, we proceed to a feat of a different kind. We lay fifteen of the dominoes in a row face downwards on the table, taking them apparently haphazard, but really choosing particular numbers, as follows: The first domino, at the left-hand end of the row, must be the double six; the next a six-five; the third either a six-four or a double five—either of these making a total of ten; the fourth a six-three or five-four—to make nine; the fifth any domino that will show a total of eight, and so on with dominoes making seven, six, five, four, three, two, and one respectively. The thirteenth domino must be the double blank, after which we complete the row with any two other dominoes we please. The fact that the dominoes are placed in this particular order is, of course, unknown to the spectators, and we must not let them see us choosing the numbers.


2. The row of dominoes as it appears after some have been moved.

We now invite anyone to shift any number of the dominoes from the right to the left-hand end of the row. While he does so we leave the room, assuring him that though we cannot see what he does, we shall know, notwithstanding, how many dominoes he moves. On our return we say: "Yes, I can tell you how many you have moved. In fact, the dominoes shall tell you themselves. I will turn up the very domino giving the correct answer." We turn up one domino, and its points are found exactly to agree with the number that has been shifted.

As a matter of fact, we do not ourselves know the number moved, but we must not let the audience suspect this. The secret lies in the fact that *the third domino from the right-hand end of the row* will always be the same as the number moved. Let us take an example. Say that the dominoes, or stones, as they are called, are, at starting, as shown in our first picture, save that they will be faces down instead of up. Suppose that three are shifted. The row as thereby altered would then be as in our second picture. We can see that the third from the right is the two-one, representing three. If four stones had been moved, the third from the right would have been a four, and so on. By way of a third trick we may next challenge anyone to arrange the whole of the stones in proper domino fashion; six against six, five against five, and so on. We show in the first place, by doing it, that it can be done. "It looks easy, doesn't it?" we remark. "But now I shall put a spell upon the dominoes, and while the charm lasts nobody but myself can do it." We mix up the stones, and now anyone may try, but he will try in vain.

The secret in this case is that in shuffling the dominoes we privately take away any two of them, *all four ends of which are different*, when the rest can no longer be arranged in a continuous row.

To conclude, we again wave our hand over the dominoes, and secretly put back one of those taken away. "Now," we say, "I will take off the charm, and you will find that you can arrange the dominoes quite easily. While you are doing so, I will leave the room. When you have finished, cover the dominoes over with a handkerchief, and I will tell you, without seeing them, the number at each end of the row." Which you do accordingly.

Here, again, the solution is simple enough. A complete set of dominoes, twenty-eight in number, may be arranged domino fashion in a complete circle or chain. If we remove any one stone, not being a double, there will be a break in the chain, and the numbers on each side of the break will be the same as those of the stone we removed. For instance, if we have abstracted a five-three, the number at the one end of the row will be a five, and the number at the other end a three. Whether the stones are actually arranged in a circle or in a straight line makes no difference. These are a few of the tricks that it is possible to do with dominoes, which may be made extremely interesting, and which will be sure to mystify the onlookers.

HOW TO MAKE PAPER FLOWERS

PAPER flowers are easily made at very little cost, and if they are well modeled, and the colored paper of which they are made is carefully chosen, it is difficult to distinguish them from the flowers they represent.

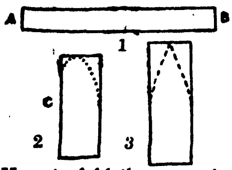
Artificial flowers are very useful for table decoration; they can be used with excellent effect as sprays for lamp-shades, and, of course, they are always in great demand at bazaars.

ROSES

Let us first consider roses, for which we need only some colored paper and a little wire. Any stationer will supply us with colored crêpe paper at 10 c. a roll, and we can buy a reel of fine wire from a florist's.

Take a strip of colored crêpe paper—red or pink or yellow—about thirty inches long and three inches wide. Fold it in half, as from A to B in picture 1, again fold in half in the same direction, then fold it in three equal parts, and once again into two equal parts. If we count, we shall find that the paper is now twenty-four thicknesses.

Take a pencil and mark as shown by dotted line in picture 2, taking care that the folded side, and not the outside edges, is in the position of C. Cut round this line with scissors and open out the paper, which will now show twelve petals. Now with one of the blades of the scissors we must *curl the edges of each petal.* To do this, hold the paper in the left hand, and with the scissors between the thumb and first finger of the right hand gently pass the blade under the petal, first curling the right side and then the left, but always curling in the same direction. Now gather the first four petals closely together and gradually gather the others round and round these.



How to fold the paper in making the rose.

Next we must make the *calyx* of the rose—that is, the little green leaves forming a cup at the base of the flower-head. Take a piece of green crêpe paper, three inches by two inches, fold it in half and then in the same direction into three equal parts. Cut as shown by dotted line in picture 3. This makes six points when opened out; cut off one, as we require only five; wrap the calyx round the outside rose-leaves and fasten with a small piece of wire. All that remains to be made now is the flower-stalk. Take a strip of green crêpe paper, seven or eight inches long and half an inch wide, and a piece of wire four and a half inches in length. Cover the wire with the green, holding the paper in a slanting direction in the left hand and gradually turning the wire with the right hand until covered. Double up one end of the stalk for about an eighth of an inch, and fasten the other end of the flower-head, and our flower is quite complete. Leaves for the rose can be bought at the shops quite cheaply.

CHRYSANTHEMUMS

To make a chrysanthemum we must take a piece of yellow tissue-paper forty inches long and five inches wide; fold it in half lengthways—that is to make a double strip forty inches long and two and a half inches wide; then with a pair of scissors cut a fringe about one and a quarter inch deep right along the strip, beginning from the folded side, not the outside edges.

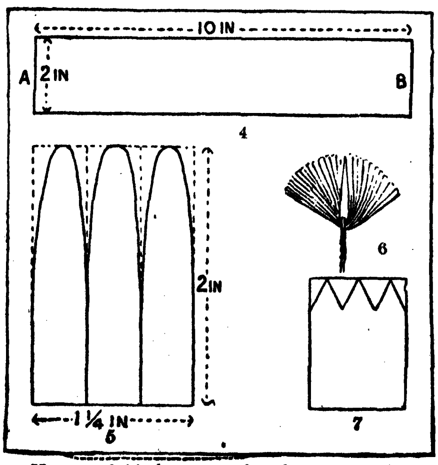
Now hold the paper in the left hand, and with the right hand take the end of the paper and wind round and round as explained above. Prepare the stalk as is shown in making the paper rose, and fasten it very firmly round the base of the flower.

YELLOW MARGUERITES

Marguerites are not quite so easy to make. Take a strip of yellow tissue-paper, ten inches long and two inches wide; fold in half, as from A to B in picture 4; fold again in the same direction, and still again, making the paper eight thicknesses.

Now take a pencil and draw three petals, as shown in picture 5. Cut with scissors and open out paper, which will now show twenty-four petals.

We have now to make the centre of the marguerite, for which we must get some yellow crewel wool, a few shades deeper in color than the paper; about three yards will be sufficient. Wind this round three fingers of the left hand, and fasten a small piece of wire round the centre of the loops, leaving a small end, as shown in picture 6. Bring the ends of the wool together and then cut the edges.



How to fold the paper for the marguerite.

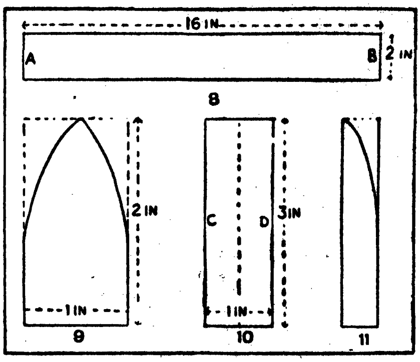
Next take a piece of green paper, three inches long and one inch wide, to make the calyx of the flower. Fold this in half; again fold in half, and cut out three peaks, as shown in picture 7.

Now take the long strip of yellow paper, double it, and gather the petals round the wool centre; wrap the green calyx outside this, and fasten with the end of the wire stalk, which should previously have been covered with green crêpe paper, as explained in making the paper rose. Arrange the petals carefully with the fingers, and the flower is finished.

This flower needs a little practice to make, but the result will amply repay the worker.

DOUBLE YELLOW DAFFODILS

We are now going to make a double daffodil. Cut a strip of yellow tissue-paper, sixteen inches long and two inches wide, and fold in half, as from A to B in picture 8; fold again three times in the same way, making the strip sixteen thicknesses. Take a pencil and mark the outline of petal as in picture 9. Cut with scissors, open out the paper, and curl the edges of each petal slightly by holding one of the blades of the scissors between the thumb and first finger of the right hand, and gently passing underneath the paper petal.



How to fold the paper for the daffodil

Now take a strip of paler colored yellow paper, six inches long and two and a half inches deep, and fold into eight pieces—that is, by folding in half three times; mark and cut outline of petal as shown in picture 9.

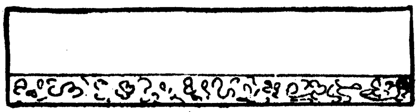
Gather the first four petals of the sixteen-inch strip together, and arrange the other petals round them; then take the paler colored piece and gather round this, and fasten all securely together with the end of the green covered wire stalk. Have you ever noticed that in the daffodil there is always a little brown, dried-up-looking leaf growing near the flower-head? We have now to make this little leaf from a small piece of light brown tissue-paper, one inch across and three inches deep. Fold it in half, as from C to D in picture 10, and cut as marked in picture 11, beginning to cut from the outside edges. Open out the leaf and fasten with some green covered wire to the stalk a little way below the flower-head.

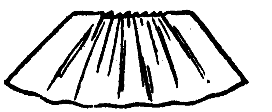
All that we now require is just a few green leaves to arrange with our daffodils. These are easily made from a strip of green crêpe paper seven inches long and one inch wide, folded and cut in exactly the same way as we have just done for the brown leaf.

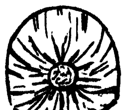
If we have followed these instructions intelligently, we shall have no difficulty in copying any other flower that pleases our fancy.

A BONNET FOR A BABY DOLL

IF you have a baby doll, here is a pretty little bonnet made of a straight piece of material, as shown in picture 1. It is gathered on one side about a quarter of an inch from the edge as shown in picture 2, leaving a straight piece on each side. When the thread is drawn quite tight, just as it has been drawn in picture 2, join together the two little straight pieces which you have left on each side of the gathers, and you will have the little round shape shown in the next picture (3), which is the back of our bonnet.

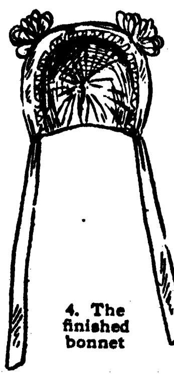

1. The pattern of the bonnet


2. The material gathered


3. The back of the bonnet

On each point of the front a ribbon should be sewn to fasten the bonnet under the chin.

To trim the little bonnet, put a flat piece of lace over the front edge of the bonnet, as shown in picture 1, while a tiny ruche, or frilling, of Valenciennes lace sewn inside all round will give a soft finish to suit the dimpled face of dolly. Make your stitches very close together so that they will not show.


4. The finished bonnet

A round piece of cardboard, about the size of a fifty-cent piece, should be covered with the material and adorned with lace or feather-stitching to cover up the gathered circle at the back.

The two little bunches of ribbon which are fastened to the top of the hat are not quite so easy to make as they at first appear. Like everything else, there is a right way and a wrong way to make a ribbon bow, and the right way to make this one is to tie a little loop with strong thread (a long thread being required), bringing another loop by the side of the first one, then a third and a fourth, always twisting the same thread round and round the ribbon without using a needle, until the rosette is quite formed, and is big enough to be put on the bonnet, where it should be secured with a couple of strong stitches. Good milliners boast of the fact that a needle never passes through their ribbons, and their bows are as fresh as if they had just come off the bolt and no hand had touched them.

Some milliners first make and trim their hats in muslin, which can be cut, sewn, done and undone until the shape is perfect, and that is the way in which you must first try to make this little bonnet. Try in muslin or crêpe paper, which is soft and elastic, and lends itself as admirably to this sort of work as to flowers.

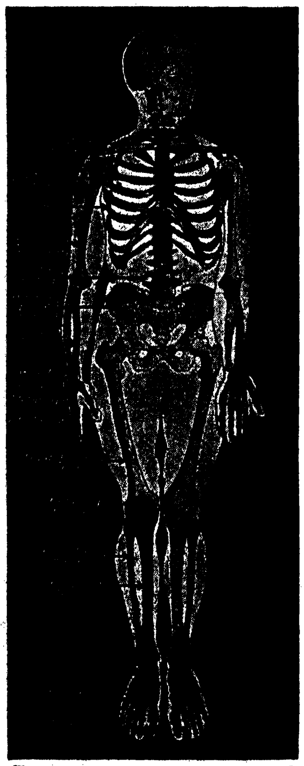
THE BONES AND ARTERIES OF OUR BODY
A SECOND LESSON IN FIRST AID TO THE INJURED

CONTINUED FROM PAGE 3964.

If we are going to be successful in rendering first aid to the injured, it is essential that we should know something about the human body, particularly about the positions of the various bones and arteries. In fact, without a pretty accurate knowledge of where the various arteries are, it would be almost impossible for us to stop a person from bleeding to death who was really seriously injured by having a large artery cut. But when we have once learnt where the arteries are to be found, we know exactly where we should apply the pressure that will stop the bleeding.

First of all it is important that we should know how the skeleton is made up, and the picture on this page will help us a great deal. We can find the various bones in this picture, and then feel where most of the bones are in our own body. The skeleton is really the framework upon which our body is built up, and in it there are more than two hundred bones, each of which has its proper name. The bones form the supports and the levers of the body. We ought to learn the names of the more important of the bones.

The head, including the face, is formed of twenty-two bones, all joined together and fixed, with the exception of the lower jaw. The head is made up of a front bone, called the frontal, a back bone, called the occipital, which means simply "back of the head," two bones forming the crown, two forming the sides, and two more the base, or floor, of the skull. Then in the face there are fourteen separate bones, including the jaws, but we need not mention these in detail.



THE BONES OF OUR BODY
Here we see their exact positions in relation to the body.

The second great division of the body is the trunk, and of this there are two parts—the chest, or thorax, and the lower part, or abdomen. Running right down the whole length of the body from the skull to the extreme end of the back, through the thorax and abdomen, is a long column of small bones joined together by cartilage, which is elastic enough to allow the body to turn from side to side, and bend forward or backward. This column has twenty-four bones altogether, and its proper name is the vertebral column, or vertebræ. These names come from a Latin word, which means to turn. The vertebral column is also called the spine, or back-bone; but, of course, it is not really one bone but twenty-four. The bones are hollow rings, and right down the middle of the column runs the spinal cord, which is really a continuation of the brain. Some of our nerves run from the brain and some from the spinal cord.

The chest, or thorax, is like a cage, with part of the spine forming the back, the breastbone, or sternum, which means breast, forming the front, and twelve pairs of curved bones, known as the ribs, forming the sides. Inside this cage are some of our most important organs—the heart and the lungs. The part of the skeleton in the abdomen is known as the pelvis, which is a Latin word meaning basin. It consists of several bones, the best known of which is a large irregular bone that comes from the back right round to the front, and the upper part of which is generally known as the hip-bone. In children this large bone is in three parts, with cartilage between to allow for growing, but in grown-up people it is all one hard bone. On each side of this bone is a socket, into which the ball-like head of the leg-bone fits, and is able to turn about when we walk, jump, dance, bend, and so on.

The other bones of the skeleton are known as the extremities, the upper extremities being the arms and the lower the legs. The arms are joined to the trunk on each side by a shoulder-blade, or scapula, and by a collar-bone, or clavicle, which means a key, and the bone is so-called because it is supposed to be shaped like a key. The collar-bone can be felt on either side of the neck like a rod. Its outer end joins the shoulder-blade. The upper bone of the arm is called the humerus, which is the Latin word for shoulder, and this reaches from the shoulder to the elbow. It is jointed to the two bones of the forearm—the radius, or outer bone, and the ulna, or inner bone. Ulna is another Latin word, the translation of which is elbow.

The bones of the hand are made up of those of the wrist, the palm, and the fingers. There are eight little bones, arranged in two rows of four, forming the wrist, or carpus, then there are five bones called metacarpus, which means "between wrist," because they come between the wrist and the fingers. They form the knuckles. The finger-bones are aptly termed phalanges, and

there are three in each of the fingers and two in the thumb. The word phalanges is really the plural of the Greek phalanx, which means battle-line, and the name was probably given because all these little finger-bones when arranged and working in proper order suggested a well-disciplined army.

The bones of the leg correspond with the bones of the arm. There is the large upper, or thigh, bone, called the femur, which means thigh. This is jointed to the two lower bones, the large tibia, or shin-bone, outside, and the thinner fibula inside. The leg has what the arm has not—a little plate of bone laid over the joint of the upper and lower bones. This is the kneecap, or patella.

The bones of the foot are very much like those of the hand, and, indeed, the French call the toes the fingers of the feet. In place of the wrist there is the tarsus, or ankle; in place of the metacarpus there is the metatarsus; and then there are the phalanges, or toe-bones, two in the great toe and three in each of the others.

We now come to the arteries. The organs that are engaged in that most important work of circulating the blood through our bodies are the heart, the arteries, the capillaries, and the veins. The heart is like a large pump, that pumps the pure blood into the arteries; these, again, are lesser pumps, that pump it into small vessels called capillaries. The word capillaries is from the Latin word for hairs, and the name is given because the vessels are so very fine that they are like hairs. The blood, having now become impure, passes into the veins, and is carried back to the heart, to the side opposite to that from which it was pumped out. It is then pumped up into the lungs, where, by our breathing, it receives fresh oxygen, and gives up its carbonic acid gas, thus being purified. By the heart and arteries it is then pumped through the body once again, and so the process continues.

THE ARTERIES OF OUR BODY

The spots show where, in case of injury, we press to stop bleeding.

It is essential that we know the position of the principal arteries, as arterial bleeding is by far the most serious. We can learn from the picture on this page the positions of these arteries, and it also shows us the places at which pressure has to be applied in order to stop bleeding. It should always be remembered that blood coming from an artery is scarlet, while blood coming from a vein is dark red.

ARTERIES OF HEAD AND NECK. The carotid arteries, right and left, pass up on each side of the windpipe, and then divide into branches, which supply the brain and head. The facial artery crosses the lower jaw, and sends branches to the chin, lips, cheeks, and nose. The temporal artery can be felt in front of the upper part of the ear. The occipital artery is behind the ear, and carries blood to the back of the head.

ARTERIES OF THE UPPER LIMBS. The subclavian artery can be felt pulsating if the finger be passed over the collar-bone at its inner end and pressed downwards and backwards, the shoulder being pressed down with the free hand, so as to bring the artery up nearly to the finger that is feeling for the pulsation. The axillary artery is a continuation of the subclavian, and can be felt if the fingers be pressed into the arm-pit while the arm is raised well away from the side. The brachial artery is an extension of the axillary artery, and runs down the inner side of the biceps muscle to the front of the joint in the hollow of the elbow. Its course may be roughly seen by looking at the inner seam of the coat. The brachial artery divides at the elbow into the radial and ulnar arteries, which course down the bones after which they are named to the wrist. At the wrist we can always feel the beating of our pulse, which is the blood passing through the radial artery. From the wrist it branches out into the hand and fingers. It forms a curve in the hand, called the palmar arch.

THE ARTERIES OF THE TRUNK. The aorta, which is the largest of all the arteries, is in the thorax. It arches up from the heart and then descends into the abdomen, where it divides, to the right and to the left, into what are called the iliac arteries.

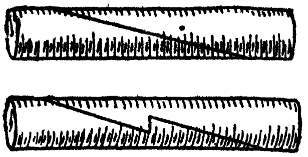
ARTERIES OF THE LOWER LIMBS. The femoral artery is a continuation of the iliac. It enters the thigh in the middle of the groin, where its throbbing may easily be felt, and passes in a winding line to the back of the knee, where it is called the popliteal artery. There it divides into two branches. One passes down the back of the leg as the posterior tibial artery to the inner side of the ankle, entering the sole of the foot as the plantar arteries. The other branch—the anterior tibial artery—passes forward between the tibia and fibula, and runs to the instep and the space between the great and fourth toes. At the instep it is called the dorsal artery of the foot. Passing over the tarsus to the sole, it forms, with the plantar arteries, the plantar arch.

In learning the positions of the bones and the arteries we should practise placing our hands upon the right positions in our own bodies.

THE NEXT LESSONS IN FIRST AID ARE ON PAGE 4288.

TWO WAYS OF SPLICING A STICK

EVERY boy, especially a Boy Scout, ought to know how to splice a stick or a pole, and as the method to be followed is quite simple, there is no reason why anyone need be unable to do this very useful work. The Camp Fire Girl also is interested in the best method of splicing a stick. By proper splicing, poles may be lengthened, broken sticks mended, and other pieces of wood extended to any length that may be required.



Two ways of splicing a stick.

The simplest method, which, however, does not give the best and strongest result, is to make a straight splice, as shown in the top picture. The two ends to be joined are cut to a sharp angle, and made to fit exactly upon one another. Then, if we are handling a pole or a beam, the two portions are bolted together, while if it is a stick or a thin pole, instead of bolting the pieces, we glue or screw them to one another. The best method of splicing, however, and by far the strongest, is that known as the bracing splice. It is rather more difficult than the straight splice, but the extra trouble is well worth while, especially if there is to be much strain upon the jointed pole or stick. Instead of there being a straight, slanting cut at the end of each portion, a kind of step is cut in each piece, and the two portions then fit each other exactly, as shown in the bottom picture. They may be fastened together by having wire bound round, if the pole is a thick one, or by using glue if we are splicing a stick. If we are splicing a new piece of wood to some article, and the new wood needs shaping to match the old, the splicing should always be done first, and then the new portion can be worked to whatever shape may be required.

THE PUZZLE OF THE TREES IN THE PARK

A GENTLEMAN who had a fine park found one day that a storm during the previous night had blown down a number of his trees, and so he telegraphed to a nurseryman to send down twenty-four young trees that might be planted in place of those which had been destroyed.

When the trees came, the owner of the park told his gardener that he wanted the twenty-four trees planted in such a way that there would be twenty-eight rows, each containing four trees in a straight line. The gardener thought the gentleman had made a mistake in the number of rows, so he asked him again how the trees were to be planted. The gentleman repeated that he wanted twenty-eight rows of four trees each, and the gardener insisted that this was impossible with twenty-four trees.

" Come into my study," said the gentleman, " and I will draw a plan for you, and you will see exactly how I want the trees to stand. It is quite easy to get twenty-eight rows with only four trees in each row."

The gardener followed the gentleman to the study, and in a moment or two the gentleman had drawn his plan, when the gardener owned that the task which at first had seemed quite impossible to him was very plain and simple. How were the trees planted? The gentleman's plan showing the twenty-eight rows is given on page 4295.

THE PROBLEM OF THE TRAVELER'S DINNER

A LONG time ago two Arabs, who were traveling to Baghdad, stopped at a small village for their mid-day meal. One of them had five loaves of bread with him and the other only three. Just as they were about to begin eating, a stranger came up, and, saying that he had money but no food, asked if he might share their meal. He promised to pay for what he had, and so the two travelers agreed to divide the loaves equally among the three, and invited him to sit down.

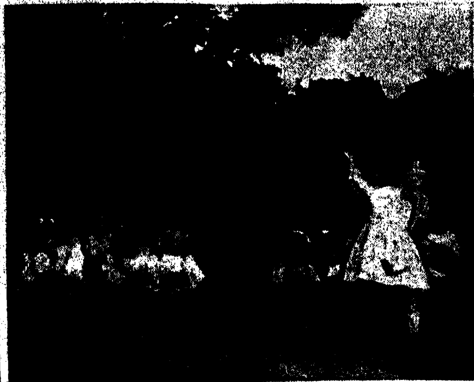
After the meal was over and all the food had been eaten, the stranger laid down eight coins of equal value in payment for the food he had eaten, and, bidding his hosts good-bye, went away. The traveler who had five loaves took up five of the coins as his share, and left three for the man who had had three loaves. But this man disputed the division of the money, and insisted that he should receive half of it.

The men began to quarrel very bitterly, and as they could not agree they went before the magistrate, so that he could decide who was right. The magistrate listened attentively to the story which the men had to tell, and then, to the astonishment of both, and of the people standing by, he said: "Let the man who had five loaves take seven of the coins and the man who had three take only one; that will be a fair division of the money." Was his decision just? The explanation which he gave will be found on page 4295.

THE NEXT THINGS TO MAKE AND THINGS TO DO BEGIN ON PAGE 4287.

GAMES TO PLAY IN THE HAY-FIELD

There are all sorts of games that can be played in the hay, and this picture shows us a new way of playing hide-and-seek. Some boys and girls bury themselves in a pile of hay, and then their companions have to identify them by the feet that remain sticking out.



It is much more difficult than we should think to guess the boys or girls by their feet. The little girl seen standing, in this picture and the last, has given wrong guesses in nearly every case. She is very much surprised when the signal is given to sit up and show faces.

Three-legged races in the hay cause much fun and amusement. Here we see two pairs of partners, their legs tied together with handkerchiefs, ready for the signal to start. A good winning-post is a rake held up by the umpire, as seen in the next picture.

The race is here shown in progress. There is no set rule as to how the players are to get to the winning-post, and we can see that while some are walking or running, others think that they can cover the ground more quickly by crawling along in the hay.

Another good form of race for the hay-field is a hopping race. The players stand in a row, and when the signal is given they start off, and must hop all the way on one foot. If they put their second foot to the ground more than three times they are disqualified.

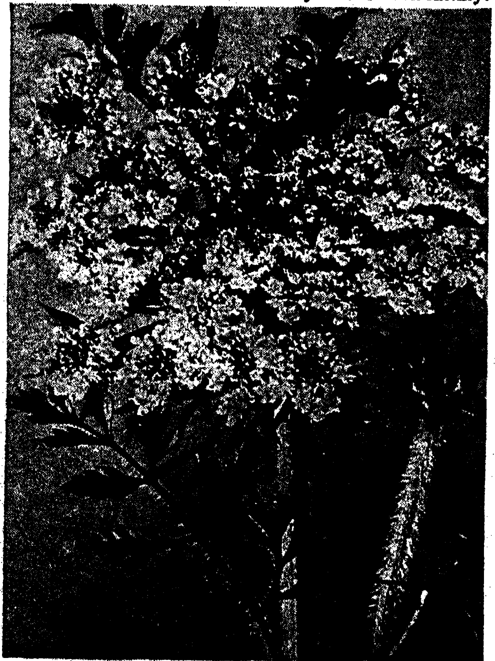
No hay-party is complete without a toy wagon to load up, and a vehicle like that shown in the picture can be easily made out of a long wooden box put on four wheels taken from an old barrow or baby-carriage. We can then take turns to ride upon the load of hay.

THE OX-EYE DAISY

This is one of the most showy members of the daisy family, the flowers being something like those of the May-weed, but much larger. The ox-eye daisy is a favorite with children, who string the flower-heads together. It is a member of the chrysanthemum family.

THE YELLOW TOAD FLAX

The flower of the toad-flax is in shape much like the snapdragon of our gardens, but, unlike that plant, it has a long spur projecting from its base. The deep yellow flowers are responsible for the name of butter-and-eggs often given to the toad-flax.



THE WILD CARROT

It is from this plant that the fine carrots of our tables have been developed. When the fruit succeeds the white blossoms, the flower-heads become shaped like curious hollow cups, and are called bird's nests.

THE COMMON RAGWORT

This flower seems to grow everywhere, and blooms in the late summer and the autumn. Its golden stars produce many seeds, and the plant spreads very rapidly. It is a close relative of the groundsel.

ROADSIDE PLANTS AND WEEDS

CONTINUED FROM 4136

BY HELEN INGERSOLL

If dirt is matter out of place then weeds may be considered to be plants out of their proper places. There are many herbs that grow in an unobtrusive manner in their native country, but when transplanted to foreign shores overrun the waysides and fields, and choke out the flowers that belong there. The same thing, as we may read in the stories elsewhere in the book, is true of insects and birds and small animals, like the rabbit. Some weeds seem to be troublesome to farmers wherever they may be, sturdy plants capable of surviving all kinds of ill-treatment and ready to seize any chance of bettering themselves.

Our roadside weeds, and the pests of the cultivated fields, have often come to us from abroad. They travel here in various ways; plants, brought over as keepsakes from old gardens, have sent their seeds broadcast, or have spread by runners; seeds have been brought in with imported seed-grains and have spilled from vehicles, or been unknowingly sown; burrs and other fruits have clung to wool and hides; and in a hundred secret ways, the weeds have crept in and humbly or arrogantly fought for a living. Once here birds and beasts distribute them. Most of the weeds are so common that a mere glance at the pictures will discover some that we know. We shall soon notice, moreover, that many of them belong to the family of bell flowers, which includes the chicory tribe, the ragweeds, and the huge group of composites.

Perhaps this may be explained by the fact that the last three families have fruits, called achenes, that are small and dry, and contain each one seed inseparably wrapped in the tube of the flower's calyx. The sepals are deformed and now appear as teeth, or scales, or bristles, hard or soft, or as stiff prickle-like objects called **awls.** These form what is called a pappus, and it may also take the shape of a little cup or crown. Sometimes it is not present at all. This curious development of the seed-vessels and calyx has gradually been brought about, in most cases, to furnish each fruit a means of traveling. For each little seedling may find much better soil or conditions for growing in some other part of the field, let us say, than in the special corner where its parent grew. A study of weeds, therefore, includes a study of their seeds. Through this study we shall discover the interesting way in which seeds are carried from place to place, and the means that each family has to send its seeds abroad. A study of the seeds also helps the farmer to find them and to destroy them.

THE SILKY PLUMES OF THE DANDELION

We have all taken a puff or two at the soft globes of a ripe dandelion head to see what o'clock it is. In a little cloud the down flies away, leaving only one or two plumes sticking to the disk on top of the stem. Let us forbear to blow these away and look at them closely instead. We shall promptly see a little spindle-shaped achene topped with a slender stem bearing a tuft of downy bristles. Pouf! Away it goes, lighter than air, the tuft of down carrying the achene swinging beneath it far afield, springing in the eddies of the breeze until it strikes a tall bush, or the wind drops and the parachute falls to the earth, and the pointed end sticks in. It has barbs, which prevent its blowing out again, and the parachute, having served its purpose, soon perishes. If in suitable soil (and nearly every soil is suitable for a dandelion), dust blows over it, or it sinks into a tiny crevice in the ground, and the early rains start it into growth.

It will continue to grow all summer, gradually choking out the grass in its vicinity by covering it with the deeply-jagged leaves, which it arranges in a flat tuft of circular outline, like many other pasture plants. In this way it may escape being clipped by the teeth of browsing cattle. The dandelion does not hug the ground so closely as other weeds, but it is provided with a milky juice so bitter that no animal wants to taste it more than once. Oddly enough this very bitterness recommends the plants to *us* as a spring salad.

By fall the dandelion has grown large and strong, and has stored much starchy nutriment in its firmly-fastened root. Even its flower-heads are pretty well developed, ready to bloom into golden buttons during a warm spell. But then it is in danger again, for the root yields a drug, and is therefore dug up.

THE CHICORY CLOSES ITS FLOWERS AT NIGHTFALL OR BEFORE RAIN

Very closely allied to the dandelion is the chicory, bearing flowers azure blue when newly opened, but often fading to pink, and sometimes occurring in a white variety. Apart from its jagged root-leaves, the chicory is very different from the dandelion in appearance. It is tall and ungainly, the branches striking out at various angles. The foliage is gray-green and scanty, and generally dusty, for the chicory haunts roadsides and waste lands. Clustered in groups on the bare stems, at awkward intervals, are the flat heads nearly two inches across, setting close to the branches. They open wide when the sun shines, but towards sundown, or if rain seems likely to fall, close by raising the rays until these stand in a close group over the centre of the flower. This is in order to protect the precious pollen, that is placed in a perilous position by heavy dampness. Each floweret, tubular at the base, is prolonged on one side into a long, strap-like ray, which sticks out not unlike a tongue, and is called a ligule. Each ligule extends over a flower in an outer row and shelters it. A ring of five anthers with stamens united stands in the tube of the floweret, and very quickly pollen is discharged through the inner slits of these anthers, filling up the tube, over the young pistil. The style of this pistil, however, when the pollen is freed, begins to grow, and as it grows it pushes the pollen up until it is piled about the opening of the tube, where rain would soon destroy it. During the closing process that we have described, the flowerets are of course brought closely together and become fertilized by actual contact, which is made very sure by having the inner rays shorter than those of the outer circles, so that the "tongues" do not get in the way. Moreover, the stigmas of the outer rings mature before those of the inner. This is because when the floweret commences to fade, as happens just at the outer edge of the head, the branches of the style, that have been shut close together while the pistil pushed through the tube, begin to spread over and curve downwards, and so expose the inner stigmatic surface, hitherto concealed, ready to pick up the pollen.

With slight differences, this description of the method of fertilization will answer as well for the dandelion, as for the chicory, the mouse-eared hawkweed and the sow-thistle, that we shall next consider.

THE YELLOW MOUSE-EARED HAWKWEED

The pale yellow flower-heads of the mouse-eared hawkweed, poised solitary on slender stalks, are not unlike those of the dandelion, but the soft, oblong, or spatulate leaves, felted beneath with star-shaped hairs, are very different. It has drifted over here from Europe, and is a

THE WILD CHICORY

The chicory is an attractive flower, something like a dandelion in size and shape, but lilac-blue in color instead of yellow. The root is roasted to use with coffee.

THE COMMON DANDELION

This is the real dandelion, although the name is given to other plants. What we call the flower is really a bunch of flowers. The dandelion is used as medicine.

THE SPEAR PLUME THISTLE

Despite the contempt that attaches to the name of thistle, we must all agree that the spear plume thistle, when it grows several feet high, and is crowned with purple flower-heads, is really an ornament to the field. It is commonly found in a fence-corner or beside a rock.

THE COMMON SOW-THISTLE

The name sow-thistle has nothing whatever to do with the sow, but is from a Greek word meaning hollow, referring to the stems. The plant is a favorite food for rabbits. It is also called the milk-thistle, because of the milky juice inside the stem.

prostrate, mat-like herb, that sends long stems running over the ground, taking root at short intervals. It is a bad pest in parts of North America, like certain other allied species.

THE ORANGE HAWKWEED THAT RUINS FINE PASTURES

The orange hawkweed, or devil's paint-brush, that sends up a corymb of flame-colored flower-heads, is very striking but also has runners and small seeds that, borne by a tuft of dusky white bristles, whisk into rich pastures, and land that cannot be ploughed, soon smothering the grasses with their useless but abundant foliage. Oddly enough, it is a very near relative of several of our own woodland plants, the rattlesnake-weeds, that meekly stay in the copses, and do not overrun the fields as the imported species do.

THE COMMON SOW-THISTLE, ONE OF OUR TALLEST WEEDS

A striking weed, shooting up to a man's height, is the common sow-thistle or hare's-lettuce, topped with small, pale dandelion-like flowers, exuding a milky, sticky juice wherever bruised, and with a spire-like effect caused by the graduation in size of the foliage from the large leaves of the base to narrow clasping ones at the top. It is fortunately an annual, haunting gardens and stubble-fields. Towards the end of summer, the tall plant is fairly veiled in the whitish heads of the fruit, each with a tuft of soft pappus-bristles. They cling to one's clothes and to weeds, and blow away in groups.

THE BRANCHING GROUNDSEL WITH RAYLESS FLOWERS

The little branching groundsel has small tassels of greenish flowers that look as if the rays had all fallen away. As a matter of fact, however, they never had any, but the plant nevertheless manages to perfect its seeds, with their little tufts, and send them far afield, landing by preference in gardens.

A BRILLIANT WEED SAID TO BE POISONOUS TO CATTLE

A very close relative to the groundsel, the ragwort, is a thick-rooted perennial, short-lived, fortunately, for it is declared to cause an odd but fatal disease of the liver in cattle when eaten by them. The old name staggerwort may refer to this. It is a tall, coarse plant bearing deeply twice-pinnatified leaves, the segments waving over and under each other, very close-set and dark-green in hue. Heavy, showy corymbs of golden-yellow flat flowers, with toothed rays, terminate the stalks. The seeds have a soft white pappus.

THE SPEAR-THISTLES ARE ROBBED BY THE GOLDFINCHES

Although we may have idly noticed that the spear-thistle is apt to be growing in a fence-corner, or beside a rock, we have probably never even wondered why. It is a striking plant with stems armed with spiny ridges, the mid-veins of the leaves running down them, and with equally prickly foliage ending in a long spear-like point. The purple flower-heads are large and handsome. Although composites, the thistle-heads have no rays. They are simply tufts of slender tubular florets, that are soon displaced by the achenes and the soft white thistle-down, which are both so attractive to the lovely little goldfinches, who eat the one, unalarmed by the spines, and line their nests with the other. Each large achene, when the scales open slightly, and allow it to escape, floats away supported by its parachute of plumy bristles. There are two other very common weeds which have no pappus whatever.

THE OX-EYE DAISY THAT TELLS A CHILD'S FORTUNE

We have all seen the sheets of white bloom that cover badly-tilled or neglected pastures, where the ox-eye daisy is in flower. White-weed the farmer calls the tall strong-smelling plant that chokes out the grass in his hay meadows, and is despised by cattle. Yet it is a member of our cherished chrysanthemum tribe and is surely very handsome with its pure-white petals, that children pick off, one by one, to see just whom they are to marry—"Poor man, rich man, beggar-man, thief."

The yarrow, that pretty roadside plant with very finely divided, fern-like leaves, is not a very noxious weed, although it is likely to give a bitter taste and strong odor to milk. It also furnishes a stimulant drug. The flower-heads, in flat-topped clusters, have greenish-white disk flowers, rather an unusual color, and white rays, and the achenes are flat and oblong.

THE BURDOCK

Another composite, which we have not always realized, perhaps, to be the cousin of the thistle and groundsel, has gone a

THE MOUSE-EARED HAWK-WEED

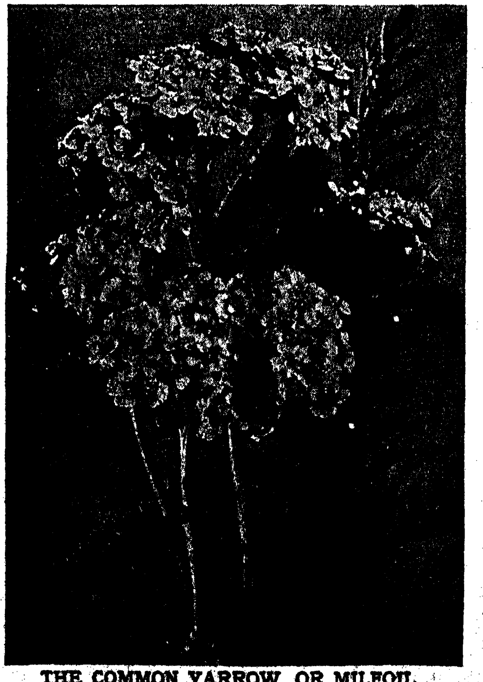
This plant is sometimes mistaken for the dandelion by those who are not botanists, its yellow flower-heads being something like the dandelion's flowers.

THE COMMON GROUNDSEL

This belongs to the daisy family, and is one of the most widely found plants in temperate regions, owing to the fluffy seeds being carried everywhere by the wind.

THE COMMON BURDOCK

This plant, with its balls of green bristles surrounding the flowers, is known to all boys, because each bristle has a hook, and when the bristly heads are thrown at anyone they at once cling fast to his clothes.



THE COMMON YARROW, OR MILFOIL

The yarrow is one of our commonest wild plants, and its flowers, that grow in dense clusters at the ends of the stems, vary from white to pink. The name is a corruption of ye arrow, a reference to the shape of the leaves.

step further in the utilization of its protective bracts, forming the involucre about the base of its globular heads of purple, tube-shaped flowers. The involucre itself is almost ball-shaped, the flowerets protruding from the top; and the closely over-lapping bracts are stiff and shaped like a lance prolonged into long spines that are spreading or are hooked at the tip. This is the burdock, a plant of dock-like appearance, and with fruits like burrs. One can easily imagine, from one's struggles with the fruits that have become entangled in the clothing, how far the "burrs" would be carried when firmly fastened in the woolly coat of a sheep, or the long hairs of a cow's or dog's coat. The burdock therefore becomes a common roadside and waste-land weed. It has its uses, however; the long tapering root furnishing a medicine for blood and skin diseases, while the great, fresh leaves form a cooling poultice for ulcers.

THE WILD CARROT, OR QUEEN ANNE'S LACE

At last we may leave the composite family, and proceed to the umbel-bearers, in which we shall find one conspicuous plant, the wild carrot, which we should doubtless admire very much if it were not so common. Queen Anne's Lace, the English children call the large disks of tiny white flowerets, poised on slender stems. The outer ones have their petals enlarged on the outer side to make the umbel more showy. And always in the centre of the whorls is a maroon-colored floweret,—why, no one can tell. The finely cut leaves are as graceful as fern-fronds. This is the plant from which our garden carrot has been developed by the gardener's patience. At night, the umbel nods, to protect its flowerets, and when time ripens the seeds, the ribs curve inwards, and the flower-head becomes a ball,—a small tumble-weed that breaks off from the stem and is whirled over the snow to pile up in a corner and shed its seeds with those of other refugees.

HOW THE BEE FERTILIZES THE BUTTER-AND-EGGS

Growing with, or under, the wild carrot is the butter-and-eggs. In England, however, people will persist in regarding it as the snapdragon. It is the common toad-flax, so called because its leaves are long and narrow, like those of the flax, and the closed lips of the flower are thought to resemble the muzzle of a toad. It is a bright, clear yellow, and the lips are marked with deeper yellow or orange to show the bee where it opens to admit her in her search for honey. Her weight, as she alights upon a pair of knobs bulging from the lip, forces it down; and as she pushes into the flower she rubs under two pairs of large stamens arching under the upper lip, and drags out of them round balls of pollen.

Smaller insects cannot press this flower open. The flowers are crowded at the upper part of the stems, thus adding to their showiness, but, even before the plant comes into flower, its numerous narrow leaves, of a whitish-green color, make it look very pretty. Sometimes the five topmost buds of the raceme unite in order to form a monstrous flower of regular form with five spurs.

THE BUTTERCUPS THAT LITTLE CHILDREN LOVE

We can scarcely cross a meadow at any time of the year without finding a few buttercups, but it is in spring and early summer that we find them well in flower. There is a general idea that the name of these plants is due to the shape of the flower; but the old English spelling was *buttercop,* and cop meant a stud or button.

Now there are many kinds of buttercup in the crowfoot family, and it is very interesting to search for them and note the differences between them. One of the earliest to flower is the meadow buttercup. It is an erect plant with large stalked leaves, nearly round or five-sided in general outline, but divided into five or more parts, and each part is cut into several broad teeth. The leaves on the branched, flowering stem are simpler in form, less divided, and without stalks. The flowers on one plant are very numerous, and both sepals and petals spread wide and flat so that the flower is more saucer-shaped than cup-shaped. It is common and has been introduced from Europe. There is one odd thing about the tribe of buttercups,—the honey is secreted in a tiny depression at the base of each golden petal and is there protected by a little scale.

THE SHEPHERD'S PURSE HAS THOUSANDS OF TINY SEEDS

In the mustard family we find two weeds so unlike that we should find it hard to believe in their close relationship

THE MEADOW BUTTERCUP

There are many kinds of buttercups, and this one is found in meadows. The flowers are called bachelor's buttons. The French name means golden buttons.

THE YELLOW MELILOT

This plant belongs to the pea family, and is dainty and graceful with its pale yellow flowers. When drying, it smells like new hay, and was once used for fodder.

THE WILD MUSTARD

The wild mustard, or charlock, is a pretty sight for the tourist, but it is a great nuisance to the farmer. It covers his fields with a waving sheet of yellow blossoms that have to be up-rooted by hand. The plant is covered with rough bristles.

THE SHEPHERD'S PURSE

This is a very common weed, and is to be found almost everywhere that man has gone. It is called shepherd's purse because the seed-vessel is like a little pouch, and shepherds used it as a charm, believing that it saved their sheep from wolves.

were it not for the four petals in the shape of a Maltese cross.

One of them, the shepherd's purse, with a rosette of narrow deeply-lobed leaves and tiny white flowers, differs greatly from the much larger charlocks in the shape of its seed-pods. These are flat and heart-shaped, and split down the middle to set the seeds free. Old-fashioned purses were shaped like this, and opened in a similar way, so we can easily guess how the plant got its name. These purses stand erect on their little foot-stalks. Its winter rosettes crowd out grass and clover, and a single plant will ripen 50,000 seeds, so in spite of its small size it is to be dreaded in meadows as well as gardens.

THE CHARLOCK'S GOLDEN FLOWERS HATED BY THE FARMER

In May, and less abundantly in later months, we shall find ill-tended lands all golden with the bright yellow flowers of the charlock, an annual of the cross-bearing family that is cordially disliked by the farmer. It is covered with rough bristles, and its leaves have their edges cut into bold teeth of several sizes. It has long, slender seed-pods containing a single row of dark brown seeds. In some places it is known as wild mustard.

THE BINDWEED, A RELATIVE OF THE MORNING-GLORY

The pretty bindweed is a pest that is very hard to kill, since it persists in an unbelievable manner owing to the vitality of its fleshy rootstocks. It trails along the ground or winds up the grain-stalks. Its large, brown seeds, like those of the cultivated morning-glory, in whose family it belongs, should be taken out of grain before it is sowed.

CHICKWEED AND CORNCOCKLE, TWO PERSISTENT WEEDS

In the pink family we have two very unlike plants. One is the humble and persistent chickweed, whose tiny white flowers open during practically the whole year. The other is the tall corncockle, with decoratively designed, pale-magenta blossoms, with characteristic radiating lines on their heart-shaped petals and long pointed calyx-lobes that form a green star beneath the flower. It has slender-jointed, hard, round stems with narrow lance-shaped leaves in pairs; the whole plant is covered with white, woolly hairs, even to the long points of the calyx.

Although the petals spread out so broadly that the flower may be as much as two inches across, we can see by pulling them out that they grow very slender at the base, and are called "claws." The flowers are self-fertilized, after allowing insects to visit them, by the elongation of the stamens until they come in contact with the several stigmas. The resulting fruit is a swollen capsule filled with little black seeds, somewhat triangular in shape and bearing rows of teeth. These capsules are often discovered in grain, and should be cast out, for they not only discolor the flour, but render it unwholesome, being poisonous. Cheap, poor flour containing cockle-seeds, when fed to poultry or other animals, causes either a quick death or one resulting later from a chronic disease.

THE BLACK NIGHTSHADE IS A DANGEROUS WEED

Among our poisonous plants we must not forget the black nightshade, another member of that dangerous potato family. It is a weak little herb, delighting in damp shady places, with wavy-edged ovate leaves, drooping clusters of small white flowers like those of the potato, and tempting, juicy, round, black berries. It is poisonous in every part, even small browsing animals being affected, and is therefore a very bad thing for youngsters to nibble.

THE BITTER-TASTING TANSY

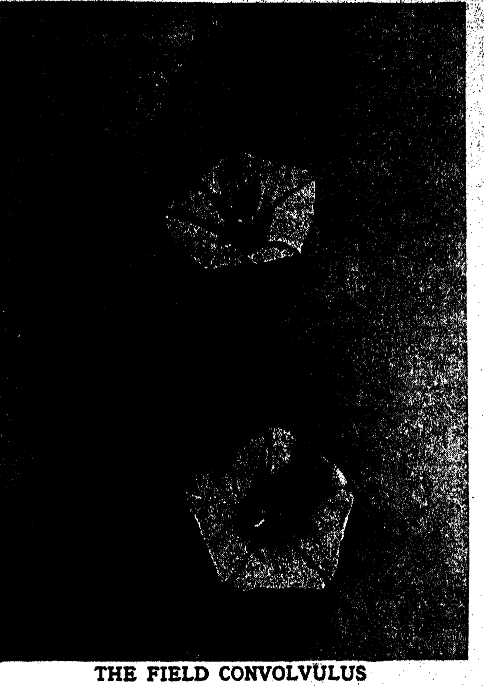
The bitter-tasting tansy, with its bunches of bright-yellow, flat-topped little flower-heads and beautiful fern-like leaves, often stands by the roadside; and in dry fields we will find shooting up the long spears of tall mulleins, with soft, yellow flowers, and plush-like leaves, so hoary and wide, which the English admire so that they cultivate our weed as a garden-plant, known as "velvet-leaf."

We have spoken of the rolled up fruiting heads of wild carrots, carrying seeds afield. There are certain other weeds, that, in the fall, also dry up, and either breaking away from their central taproots, or pulling them out of the dry soil, roll themselves into balls and are blown hither and yon across the open plains. Such are the dreaded Russian thistles, which are very like the prickly saltwort of our beaches, and a related "tumbleweed" of the prairies. Both belong to the goosefoot family.

THE NEXT NATURE STORY IS ON PAGE 4349.

THE CORN-COCKLE

The rich crimson-purple flowers of the corn-cockle, measuring about two inches across, are conspicuous in grainfields from June to September. The plant itself grows four or five feet high, and the stems, on which the flowers grow singly, are covered with hairs.



THE FIELD CONVOLVULUS

It seems a pity that the pretty little field convolvulus, or bindweed, that is so common in our grain-fields and other cultivated ground, should be a dangerous pest to farmers and gardeners, strangling almost everything that it twines round as it climbs.

THE COMMON CHICKWEED

The chickweed flowers from spring to autumn, but it is an untidy plant. It thrives well in a garden, where we do not want it. Canaries like the seeds.

THE BLACK NIGHTSHADE

This is a dangerous plant to meddle with, for the green parts are poisonous and the purple-black berries are very injurious to children. The flowers are white.

WASHINGTON AS A YOUNG MAN

The likeness of Washington we usually see is made from the Stuart portraits. This, by Charles Willson Peale, represents him as a much younger man, before his mouth had been changed by the loss of his teeth. Washington is here shown in the brilliant blue and scarlet uniform of a colonel of Virginia militia.

WHAT THIS STORY TELLS US

THE founders of our country had small leisure and little money for pictures. Besides many of them were stern Puritans, who were inclined to think that pictures were sinful. But after the first hard years had passed, and the settlements became more prosperous, the love of beautiful things which is planted in all our hearts, claimed means of expression, and boys began to attempt to paint pictures. We have not space in this story to tell of all the hardships that the men who made the early history of our art encountered. Many of them were self-taught and had not even good pictures to copy. Some of them had to tramp through the country, painting portraits for a few dollars, to earn their daily bread. But they struggled on, attempting to reproduce the beauty that they saw, and on the foundation that they built, a national school of painting grew up, to which we may point with pride.

PAINTERS OF THE UNITED STATES

CONTINUED FROM 4164

THE people who settled our country had fled away from home, trying to live as they thought best and right. They were far too busy, clearing the wilderness, making new homes and protecting these from wild beasts and wild Indians to think about art. They seldom saw a picture. Indeed the old Puritans were inclined to condemn the beautifying of life by art and music, as wrongful waste of time. But when their early difficulties were over and life easier, they became less severe. A few paintings gradually found their way across the seas, but there was little or no American art until the middle of the eighteenth century. As is always the case, when life became so civilized that it no longer took all a man's energy to provide for the needs of his body, he felt stirred to desire higher interests, art and literature and music.

The first pictures were all portraits. There were, of course, no photographers in those days, and many of the first painters tramped through the country, painting portraits—limning, they called it—for a few dollars each.

A certain Swede—Gustavus Hesselius—is said to have been the first painter in this country.

OUR EARLY PORTRAIT PAINTERS

Our first important American painter was Benjamin West, born of Quaker parents near Philadelphia, in 1738. He had no early training, but fascinated by the colors, the vivid reds, blues and yellows with which the Indians painted their bodies, he taught himself much by experimenting with these. A gentleman interested in the boy's efforts, gave him a paint box, and very soon he was successfully painting portraits. When he was twenty-one another friend sent him to Rome and from then on he won great success. Much of his life was passed in London, where he was knighted, became very popular, and where he succeeded Sir Joshua Reynolds as president of the Royal Academy. He had the kindest feeling for needy art students and helped many a talented young American. He died in London in 1820, and was buried in St. Paul's Cathedral with impressive ceremony.

His work, once so greatly admired, looks somewhat hard and out of drawing to the modern critic. But he deserves to be remembered because his pictures show imagination, something more than merely faithful copying of the sitter's outward aspect, and because he pointed the way to others of greater talent.

John Singleton Copley is one of the most illustrious of our early painters. His parents were Irish, and his father was a tobacconist in Boston when the

artist was born in 1737. Soon after, his father died, and later his mother married Peter Pelham, a painter and engraver, who gave his stepson valuable training. For a time Copley worked at engraving but soon took to portrait-painting. His subjects were the aristocrats of the New World, men and women of character and culture, and he was especially successful in conveying a sense of dignity and personal distinction. One of his best known portraits is that of Lady Wentworth, then a Boston belle of nineteen.

Copley himself, handsome, clever in conversation, of delightful manners, was a great favorite in New England society. When thirty-two he married Miss Clark, the daughter of a wealthy merchant, the very man to whom was consigned the famous cargo of tea flung into Boston Harbor a few years later. Our early artists, however successful, felt the lack of artistic atmosphere. They longed to study the pictures of the Old World. At the height of his success, Copley went to Rome, and later to London, where he was welcomed by West and remained until his death. His son became Lord Chancellor of England.

Philadelphia has the distinction of being our earliest art centre. At the dawn of the Revolution it was our biggest city, as well as the richest and most fashionable. From early days, Philadelphia had been rather more liberal-minded toward the arts than severe New England. Perhaps the most famous of early Philadelphia painters was Charles Willson Peale. Like many another American artist he began as an artistic craftsman. He became an expert worker in wood, leather and metal. Then the Swedish painter, Hesselius, gave him drawing lessons and he decided to be an artist. He went to Boston to study with Copley, and then to London, where he studied with Benjamin West. He then returned to this country, where his first important work was a life-size portrait of George Washington in the striking blue and scarlet uniform of a Virginia colonel.

Peale himself became a soldier of the Revolution and fought bravely in the battles of Trenton and Germantown. He began his second portrait of Washington,—a commission from Congress,—in 1777, during the dreary waiting at Valley Forge. He painted fourteen portraits of Washington, and the portraits also of many other distinguished men. Peale deserves to be remembered for other services to American art. He organized the first exhibition of paintings ever held in this country and was one of the founders of the Pennsylvania Academy of Art.

Gilbert Stuart, another painter of lasting fame, was one of the first to paint with individuality. The son of a Scotch refugee and a Welshwoman, he was born at Narragansett in 1755 and showed his talent for drawing as a child. He was eighteen when a Scotch artist, visiting in this country, gave him lessons, and invited him to go back to Scotland with him. Young Stuart was placed in the University of Glasgow, but his protector died, and the boy, poor and homesick, was glad to make his way home on a collier. His family were Tories, and at the outbreak of the Revolution, he fled to London. There he was befriended by West, who took him as assistant, for which position, however, he was too independent in ideas and methods. He formed his own theories of painting and was perhaps the first to present his subjects as he saw them with freedom and naturalness, until then unknown. His work marks a great gain in lifelikeness and sincerity.

Among his most famous portraits are those of Dr. Fothergill, a distinguished Quaker physician, and the one of George Washington known as the Athenaeum Portrait, now hanging in the Museum of Fine Arts in Boston. Stuart lived in Boston from 1794 until his death in 1828.

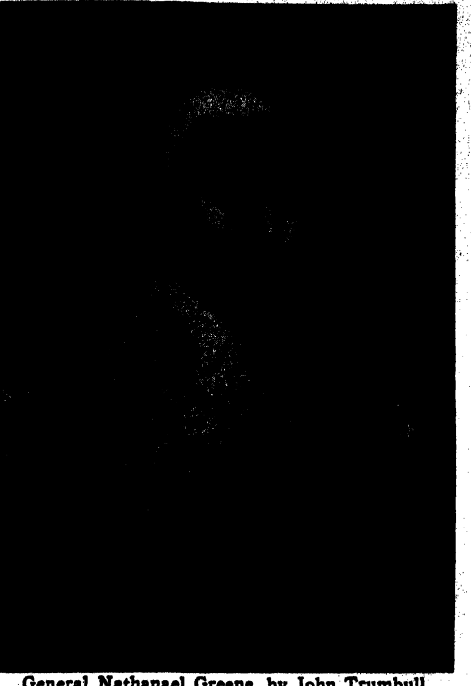
PAINTERS OF HISTORICAL PICTURES

When the great struggle of the Revolution ended, the spirit of patriotism, which had been kindled and strengthened by sufferings endured, found expression in art. Our artists were no longer satisfied to paint only portraits. Henceforth we have pictures representing historic and stirring scenes.

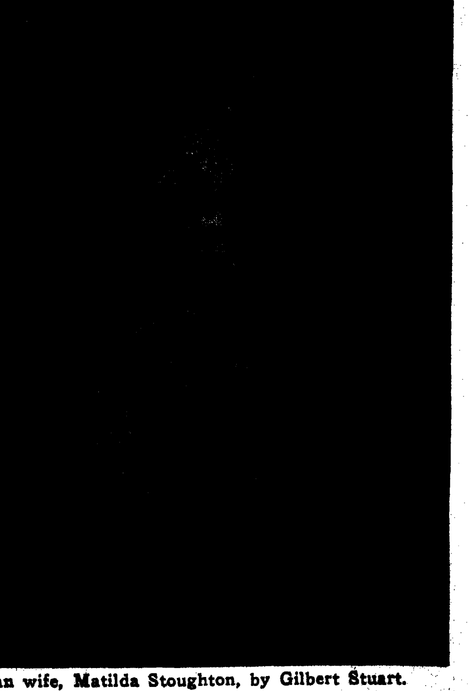
John Trumbull has been called the connecting link between the early portrait painters and the painters of landscape. Born in Lebanon, Conn., the son of a colonial governor, and graduated at Harvard, he fell under the best educative influence of his day. As a mere boy, he joined the Revolutionary army and was soon making himself useful to Washington by his skilful drawing of the

EIGHTEENTH CENTURY PORTRAITS

Mary Storer, by J. S. Copley.



General Nathanael Greene, by John Trumbull.



Don Josef de Jaudenes y Nebot and his American wife, Matilda Stoughton, by Gilbert Stuart.

These four portraits by Copley, Trumbull and Stuart give us a good idea of the work of our early American painters. The pictures by Trumbull and Stuart are good examples of the artists' painting, but the portrait by Copley is stiff and a little hard. It is from pictures such as these that we have gained a knowledge of how our forefathers looked and what they wore, so that they are not only interesting pictures, but valuable historical documents.

All the pictures for this article, except the portrait of General Greene, are from the collection of the Metropolitan Museum of Art, New York City.

enemy's works. He resigned from the army, went to France, then to London, where he too studied under West. He had a hard experience, for the English Government, indignant at the execution of Major André, threw him into prison for eight months and then ordered him out of the country.

The very stirring history then in the making, fired his imagination to paint great historical scenes such as The Battle of Bunker Hill. How highly esteemed Trumbull was in his day may be seen by the fact that Congress commissioned him to paint four paintings for the Capitol, for which $32,000 was appropriated, a far greater sum in those days than now.

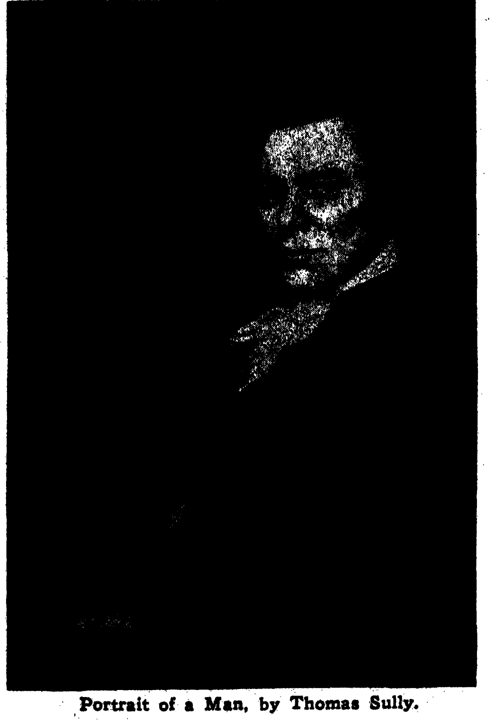
In studying the development of American painting, it is wonderfully interesting to see how with growing powers and growing opportunities, and also as the public developed artistic understanding, our artists reached out to fuller and more varied forms of expression.

Washington Allston was one of the first to develop real sense of color. He was one of the few Southern early American artists and was born in South Carolina in 1779. But he was educated north, at Newport, R. I., and then at Harvard.

Allston had the advantage of four years' study in Rome, where he enjoyed the companionship of many distinguished people, among them Keats, Shelley, Byron, and Turner. The life in Rome kindled his imagination, stimulated him, the critics say, to attempt more than his talent could perform. The Dead Man Restored to Life is one of his best known pictures. Even if his achievement was not great, as a man of high ideals and thorough training he favorably influenced American art.

Edward Malbone, who was a boyhood friend of Allston's, was a miniature painter, whose work is prized almost as much as the work of the best European miniature painters. He died at the early age of thirty.

Although less well known than some of the other men of whom we have been reading, Thomas Sully was one of the best of our early American painters. He was not of American birth, having been born in England in 1783. He was nine years old when his father and mother, both of whom were actors, brought him to Charleston in South Carolina and made their home there. As a youth, he studied painting with his brother-in-law, a miniature painter in Charleston, and was afterwards a student of Gilbert Stuart's for a short time. When he was a young man he set up a studio in New York, but did not meet with success. He felt the need for more study, and, with a few hundred dollars, he went to London to work under Benjamin West. He stayed in London as long as his money lasted, and then returned to Philadelphia,



Portrait of a Man, by Thomas Sully.

where he lived for the rest of his life. He painted portraits of three of the presidents of the United States, and, after Queen Victoria began to reign in England, he once more went to London to paint her portrait for a society in Philadelphia.

Sully did not draw very well, but his colors are warm and fresh, and his portraits are lifelike and without the stiffness given by many of the portrait painters of his time.

Before they had gone very far, American artists felt the need of banding together for enlightenment and encouragement. The very earliest Academy of Fine Arts, that of New York, founded in 1801, was soon discontinued for lack of money to support it. The next, that

This picture was painted by Thomas Doughty, the first American artist who began to paint what he saw out of doors. Unlike the artists of our time, he tried to paint every detail in the landscape. Even the leaves of the trees and shrubs are painted with great faithfulness. Doughty may be called the first of the national school of landscape painters. He did not begin to paint seriously until he was thirty.

This picture of a Spanish girl by Washington Allston is quite imaginary, as the painter was never in Spain. Allston had an excellent sense of color, but critics say that his talent was not great enough to enable him to carry out successfully the ideas with which his imagination teemed. The picture is a good illustration of the work of this artist, whose life and ideals had a good and enduring influence on American art.

of Philadelphia, is still enjoying an honorable life. In 1870, Boston incorporated its Museum of Fine Arts. The very next year the New York Legislature granted a charter to the Metropolitan Museum of Art and later the city made an appropriation for the Museum Building in Central Park. The more the people saw pictures, the more they loved them and wanted to own them.

THE HUDSON RIVER SCHOOL

All the men of whom we have been reading are remembered as portrait painters, but we now come to the founders of our school of landscape painting. The forerunner of this school was Thomas Doughty, who was born in Philadelphia in 1793. His life gives us a good idea of the difficulties encountered by artists in the early days of the country, especially after it seemed to be more than ever cut off by the Revolution from the culture of the Old World. Doughty began life as a leather merchant. He was thirty before he began to paint, except as an amusement, and was almost forty years old, and had gained a good reputation before he was able to travel abroad and study. He painted a good many landscapes, some of which have much charm. His chief claim to distinction is, however, that he was the first to draw the attention of American painters to the beauties of their own country.

As the number of our artists multiplied they sought helpful intercourse with each other. A group of painters who lived and worked along the Hudson in the early nineteenth century has been given the name of the Hudson River School.

Of these, one of the earliest and most famous was Thomas Cole. He was born in England, the son of a wall-paper maker, and came to this country with his family when nineteen. He first studied art at the Philadelphia Academy. From there he went to New York and then sketched and painted along the Hudson and in the Catskill Mountains until his work attracted the attention of the artists Trumbull and Durand. For a time Cole was very successful. He traveled abroad, and his work was exhibited in the Royal Academy. He painted great series of pictures in which his romantic imagination took the scenes among which he lived and made them the setting for a poetic allegory. One of these was The Voyage of Life. Another, The Course of Empire. They have a kind of story charm and are impressive from their very bigness. There is much beauty and feeling in the landscape part, but gifted though Cole unquestionably was, his style has long been obsolete. His name is generally associated with that of A. B. Durand, who was older than he was by some years.

A. B. Durand, who was born in the little town of East Orange in New Jersey, commenced life as an engraver, but after a time began to paint portraits, and after some years devoted himself to landscape painting. He may be said to have studied painting from the pictures which he engraved. He learned to draw very well, perhaps in faithfully copying the pictures which he engraved, but the composition, or arrangement, of his pictures is not always good.

These three men—Doughty, Durand and Cole—taught our artists to turn to landscape painting, instead of devoting themselves exclusively to portraits. Their work is not great, but most of it is good, and they have an important place in the history of our art.

Our artists were discovering how great and full of resources our young country was. We were proud of its bigness. The artists of the day sought great subjects. One of Albert Bierstadt's most famous paintings is the Yosemite Valley. Thomas Moran revealed the Rocky Mountains to the stay-at-home public, while F. E. Church painted Cotopaxi. From Trumbull's day we have had painters of historical scenes. Emanuel Leutze's present claim to remembrance rests chiefly on his historical painting Washington Crossing the Delaware. Leutze was born in Germany in 1816 but was brought to Philadelphia as a child.

Leutze had a pupil, Eastman Johnson, who became more famous than himself. Johnson was a New Englander, born in Lowell, Maine, in 1824. While still very young he became noted for crayon portraits, first in Lowell and later in Washington and Boston. He earned enough to take him abroad to study at Dusseldorf, then a very popular art centre. From there he went to Holland, where he studied Dutch art for four years. It influenced him greatly in choice of subject and in knowledge of color. He returned to America an accomplished

artist, and his pictures of country life and of subjects suggested by the Civil War, became very popular.

For some time our artists flocked for training to the art schools of Munich and Dusseldorf. Then they began to seek Paris. Increasing knowledge of French art exercised a powerful influence upon them. The brilliant school of modern realism as seen in such works as Millet's made merely pretty pictures, conventional in treatment, seem tame and unsatisfactory. Our artists began to aspire to pierce through pretence and illusion and reveal genuine underlying truth. They wanted to show spirit as well as substance.

DISCIPLES OF FRENCH ART

For fifty years and more all ambitious art students have longed to go to Paris. Among the earliest of those to seek the Paris art schools were three of our most distinguished painters, William Morris Hunt, George Inness and John La Farge.

Hunt was born in Brattleboro, Vermont, in 1824. He was a delicate youth, compelled by ill health to leave his course at Harvard unfinished, and go abroad. He went first to Dusseldorf, where he joined the Art Academy, expecting to become a sculptor. Then he went to Paris, decided to become a painter and entered the studio of the famous Couture. Later he fell under the influence of Millet. The first taught him drawing and technique, the second taught him the greater lesson of sincerity and noble perception.

The time had come when American artists, unlike those of an earlier day, were unwilling to expatriate themselves for the sake of a more artistic atmosphere. Mr. Hunt returned to America, and after living for a time at Newport, R. I., moved to Boston, which became his permanent home. In spite of much admirable work he may perhaps be said to have helped American art more as teacher than as artist. His delightful personality won his pupils to his views and the ideals he held before them were of the highest.

The many-sided genius of John La Farge had every opportunity for development. Born in New York in 1835, he grew up in a home where books and art were greatly loved and appreciated, and which was a gathering place for gifted people. He was sent abroad when twenty-one, visited Munich, Dresden, and London, and in a long visit to Paris, met the most brilliant French people of the day.

Although greatly fascinated by modern French art, and in spite of his great talent, he had a strange reluctance to becoming an artist. He returned to New York and entered a lawyer's office. He said himself, "No one struggled more against his destiny than I." When he finally decided to devote himself to art, he went to Newport to study with Hunt.

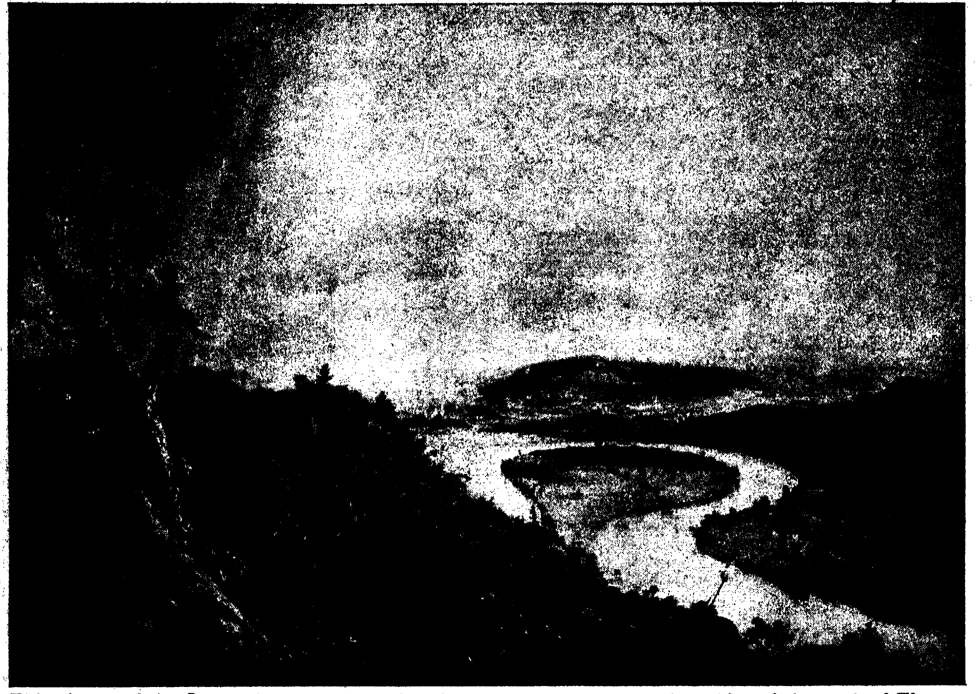
Much of his best known work is mural decoration. In this he was well served by one of his greatest gifts—wonderful sense of color and power of handling it. His predecessors believed that they had only to copy the colors of nature. La Farge analyzed and learned the effects of light on color. He was essentially a scientist, needing to know the how and why of effects. He says, "There is in each competent artist a sort of unconscious, automatic mathematician." Christ and Nicodemus, and The Golden Age, are among his well-known pictures. Young visitors to New York should see his great pictures in St. Bartholomew's Church and in the Church of the Ascension.

No one event ever had so great an influence on American art as the Centennial Exposition at Philadelphia. For there many American people had for the first time in their lives an opportunity to see great pictures. It was about the same time too that the first of our young artists to study in Paris studios were returning to begin their life-work in their own country. They brought with them new theories of art, very different from those hitherto accepted. As a direct result the Society of American Artists was formed. John La Farge was elected its first president, and its membership included many of whom America is now proud.

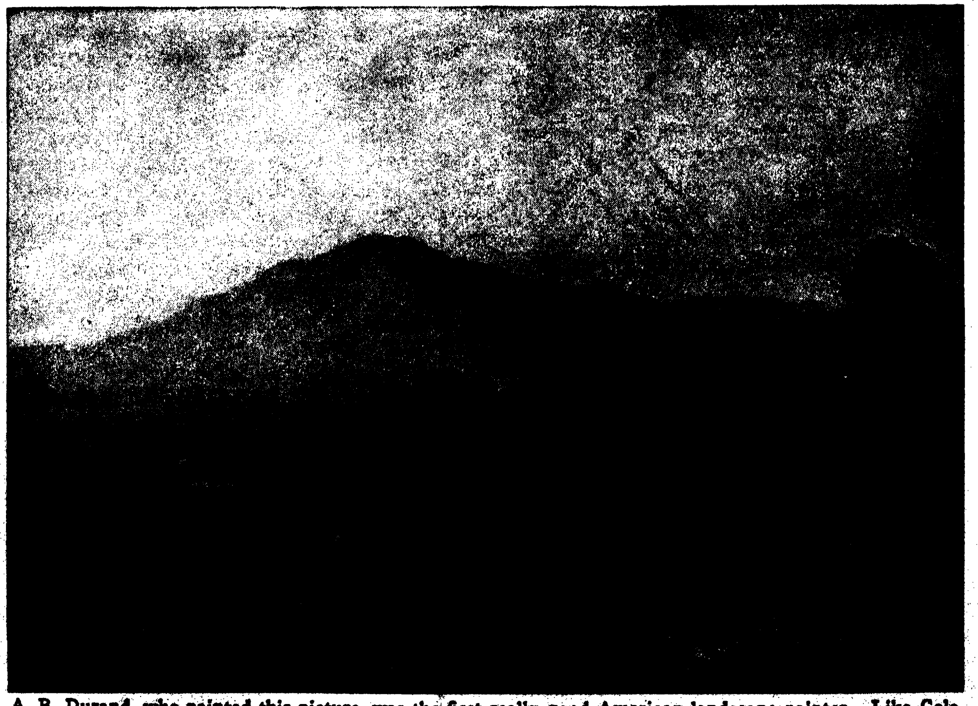
In his later life, La Farge turned his attention largely to the making of stained glass windows. He invented a special kind of glass to carry out his designs, and produced noble windows for Trinity Church in Boston. In this art he has been followed by Louis C. Tiffany, who was a pupil of George Inness, of whom we shall speak later on.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 4247.

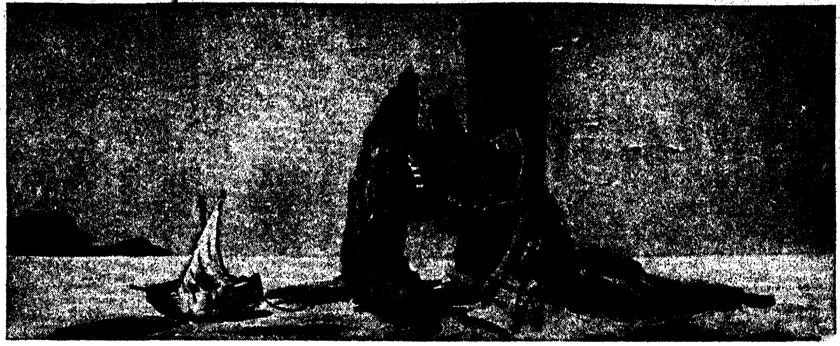
PICTURES OF THE HUDSON RIVER SCHOOL



This picture of the Connecticut River near Northampton gives us an excellent idea of the work of Thomas Cole. All the details of the scene are so clearly worked out that no one who had visited it could fail to recognize it. Every bush and rock is carefully painted and even the sheaves of grain in the field may be counted. Thomas Cole was one of the first among American artists to devote himself to landscapes.



A. B. Durand, who painted this picture, was the first really good American landscape painter. Like Cole, he painted every detail that he saw in the landscape. The chief value of his work is the beauty of his drawing, which you can see even more clearly in this reproduction than in the picture itself. Notice how beautifully the trees stand out in the foreground, and the clear line of the mountain tops against the sky.



THE TOILERS OF THE SEA

WE have read many famous books in English literature, and will turn now to some of the great novels of French authors. Victor Hugo is a romancer of world-wide fame; his is one of the most illustrious names in the literary annals of France. "The Toilers of the Sea" is not his greatest work, but it is the most suitable for our book, and it is a very fine story of heroism and self-sacrifice. It was written while the author was an exile in the Channel Islands, the natives of which are of French descent, though they are British subjects.

CONTINUED FROM 4142

AT the town of St. Sampson, in the isle of Guernsey, lived an old seaman, Lethierry by name. The pride of his life, his chief and only care, was his beautiful niece, Deruchette, whose future he meant to make happy and comfortable, so far as honest toil could ensure.

A man of unusual strength, he was accustomed all his life to great bodily exertion, and now, when he was engaged in the strenuous work of shipbuilding, he found himself at fifty years no longer able to lift his three-hundred-pound anvil with one hand! This made him think that he was not so young and vigorous as he used to be, and that he must lose no time in gathering together that little fortune for his niece.

Now, Mess Lethièrry was not only a man of courage, as he had proved many a time in the teeth of vicious seas, but his good sense told him that when he was satisfied with a new idea it would pay him to be bold and risk every penny he possessed on it.

Thus he set himself confidently to the building of quite a new kind of ship, which, unlike all the others he had built before, was not to depend on sails, but on strange machinery worked by boiling water for its means of motion. There, day after day, in his shipyard at St. Sampson, he plied his skill and spent all his money on the making of this new ship, and when at last the wonderful engine arrived, and was fitted in its place, Lethierry had grown almost as fond of the Durande—for so he christened his boat—as he was of his adorable niece, Deruchette.

At length the great day came when, with much noise and the belching forth of smoke like a small volcano suddenly grown active, the Durande, its whirling paddles suggestive of monstrous fins to the simple fisherfolk, who had never before looked upon a steamship, began its new life as a coasting steamer. As it could carry far more cargo than the old-fashioned coasters, and do its journeys from port to port in much less time, the Durande was a success from the first.

The happiest days of Mess Lethierry's life had now come, for he felt himself the luckiest of mortals, as he stood there on his wonderful steamboat and directed it among the ports of the Channel Islands or across the often dangerous waters to the old pirate town of St. Malo, on the rocky coast of France. Happy and prosperous years passed thus, until the

captain's joints were so stiffened with rheumatism that he had to give up the command of his boat to a clever sailor named Clubin, who was supposed to be as honest as he was skilled in the ways of the sea.

This Clubin, however, was noted for his honesty simply because he had not yet had an opportunity of proving what a rascal he was at heart. He had been patiently waiting for the chance to come when he might enrich himself at his employer's expense, and make off to some place where, with his ill-got gains, he might enjoy himself better than toiling in the stormy waters of the English Channel. To help him at the right moment, he possessed himself of a very cunning invention, which a man from America had sold to him, in the shape of a revolver. He knew that the time had come when this would enable him to play his master-stroke.

Clubin had brought the Durande into St. Malo, and it was there he meant to make his bold stroke for fortune. Armed with his revolver, he betook himself some distance from the town to a little wood close by the edge of a great cliff that threw its shadow far below on the waters of the Channel.

A VILLAIN'S MASTER-STROKE IN A GREAT GAME FOR FORTUNE

There, on the edge of the cliff, he saw a coastguard watching a vessel that lay some little way off-shore. A small boat was being rowed from the vessel towards the cliff. While the coastguard stood watching, a tall and muscular sailor crept from the shelter of the rock as silently as a cat, and, striking him a deadly blow between the shoulders, sent the unsuspecting watcher headlong into the sea. As the murderer stood calmly looking at the rippling circles where his victim's body had disappeared, Clubin stepped softly from his concealment, the useful revolver in his hand.

"You have just killed a man, Rantaine," he said quietly.

At this the murderer turned quickly, only to find himself facing Clubin's wicked little weapon.

"Stand where you are," said the captain, "for I have six shots here, and they may either kill you or alarm the nearest coastguard."

Dismayed and cowed by the warning click of Clubin's revolver, Rantaine asked what he would have of him. "Yesterday I watched you," said Clubin, in a voice of irritating softness, "while you went to a money-changer and got from him three English bank-notes for one thousand pounds each, in exchange for seventy-six thousand francs. This money you had stolen from Mess Lethierry. Then you arranged with the master of that ship out there to make good your escape. The notes are in your tobacco-box. Don't deny it; but just put your hand in your pocket and throw the box over to me."

DIAMOND CUT DIAMOND, OR TWO RASCALS AND THREE THOUSAND POUNDS

Never for a second did Clubin cease to cover the other villain with his revolver, and Rantaine, with many a vain curse, protesting that he was as helpless as a child before that thing, at length did as he was commanded. When Clubin had assured himself that the banknotes were safe, he said:

"You may go; your boat is near."

And down the perilous cliff the outwitted rascal scrambled. Once in the boat, he called back that he would write to Lethierry to say that he had paid over three thousand pounds for him to Clubin. The latter heeded not, but quietly returned to St. Malo. The first move in his great game had been won!

That night the master of the Durande began preparations for sailing next morning, though all the mariners expected it would be a day of fog, and he knew this as well as any. In the morning, however, as the Durande steamed away from port, the sky was so bright and the sea so calm that the prophecies of fog seemed foolish.

THE CAPTAIN OF THE DURANDE PREPARED FOR THE SECOND MOVE IN HIS GAME

For hours the vessel made its way, and the passengers on board had hopes of a calm and uneventful voyage, when suddenly a bank of fog was seen on the horizon. This increased until the steamer on its onward way had become engulfed in it. But there was no slackening of speed. The Durande still forged ahead. A feeling of uneasiness seized all on board when the engineer was heard to say to his assistant: "This morning in the sun we were going at half speed, and now we are ordered full speed ahead in the heart of the fog."

It seemed but a few moments after

this that the vessel struck on a great rock. It was as though the Durande had leaped from the waters and impaled herself on some strange mountain peak thrust up through the sea. But while all was excitement and disorder, the captain of the vessel was cool and collected. He had the long-boat quickly launched · passengers and crew hurried into it.

THE WRECK OF THE DURANDE IN THE FOG IN THE CHANNEL

"Push off!" he called out, when urged by them to jump in. "I shall stay here, for when the ship is lost the captain is lost also!"

Little though the passengers and crew guessed it, as they pulled away in the ship's boat, this was the second move in Clubin's game for fortune. And, little though he knew himself at that moment, it had not succeeded. His scheme had been to steer the Durande on to a group of rocks only a mile from shore, and by swimming that distance, an easy feat to him, he would have gained a deserted part of the coast. At some lonely farmhouse he would get dry clothing, and later make his way to a distant port, so escaping with the three thousand pounds.

It was, therefore, with a terrible change from satisfaction to dismay that Clubin discovered, during a momentary lessening of the fog, that his vessel had struck the terrible Douvres rocks, full five-and-twenty miles from shore! Yet he did not utterly despair, as smugglers often passed near these weird rocks, and might take him off without questions if he paid them well.

As the fog gradually lifted, and Clubin wished to take his bearings, he decided to gain the summit of the higher rock. To do so he needed to plunge into the sea and swim to the reef.

THE DOUVRES ROCKS AND THE DOOM OF THE WICKED CAPTAIN

Stripping himself of most of his clothing, and fastening a belt around his waist, with the precious tobacco-box, he dived from the wreck. The water was deep, and he dived well. But he did not come up again, for as he went down he had been seized by some strange thing, in whose grip was death.

The shipwrecked crew and passengers safely reached St. Sampson that night, and great was the consternation when it was known that the Durande had struck the Douvres. Lethierry could scarcely realize his loss. He was stunned, like one who has suffered a great bereavement. The captain of a cutter which came in later reported having seen the wreck and watched it in the now boisterous sea being hurled farther on the rocks, and held fast between the two giant pillars of the Douvres. There was no sign of Clubin anywhere. He thought that while the vessel's hull was beyond repair, the engine might be intact.

For a moment old Lethierry's spirits revived at the thought of the engine being saved. Only for a moment. He knew too well the terrible nature of these rocks, their scant foothold, and the almost incredible labor that would be necessary to cut the engine out through the wooden decks and plankings.

"No, it is all over," said the captain of the cutter, as if he were answering the thoughts in Lethierry's mind. "There does not exist a man who could go to these terrible rocks and save the machinery of the Durande."

THE FISHERMAN WHO WENT TO FIGHT THE SEA FOR THE DURANDE'S ENGINE

"If he existed," exclaimed Deruchette, who had been trying to console her uncle, "I would marry him!"

"You would marry him, mademoiselle?" said a tall young man, almost in a whisper, when he had made his way from the outside of the crowd, and stood before her. He was a fisherman named Gilliatt, so quiet and determined that many thought him strange.

The eyes of all were directed on him as old Mess Lethierry said, with great solemnity, that Deruchette should be the wife of him who could save the engine.

The next night the fishermen and lighthouse-keepers were speaking of some madman whom they had seen piloting a strongly-built sloop out through the most perilous passages of these rock-studded seas into the darkness. It was Gilliatt of whom they spoke; for he had determined to win the prize which had seemed beyond his wildest dreams. He was bound for the Douvres rocks, and he was taking the shortest way with all its dangers, as not a moment was to be lost in this battle with the sea.

Out into the dark he sailed, threading his way as none other would have dared. Out from the darkness to the dawn, and so into the broad light of day, which

was shining on the grim and desolate Douvres when Gilliatt brought up his sloop there. The two giant pillars of rock held up the broken vessel almost like a nut in a nut-cracker. But Gilliatt had no time to marvel at the sight. Making fast his vessel, he sprang ashore and climbed to the wreck.

HOW GILLIATT BEGAN HIS BATTLE WITH THE SEA AT THE DOUVRES

His examination proved that the after-part, with the precious machinery and paddle-wheels still intact, had been driven firmly between the two upstanding rocks, while the fore-part of the vessel had broken off and sunk into the sea. Quickly the brave fisherman mapped out the situation, and determined on his plans.

There, once a dangerous passage had been overcome, was a piece of sheltered water where his sloop might rest secure. When the tide was low he could go between his own boat and the wreck by jumping from rock to rock, but at high tide the sea would cut off this connection, and, as it was impossible to make a shelter for himself on the wreck, all that he could do was to choose the top of the higher of the two rock pillars as a refuge during high water. To this he could climb from the wreck by throwing up a knotted rope to which he had fixed a grapnel.

In a cavern of the rock he slept the first night, and found when he awoke next day that his food-supply had been blown into the sea. Nothing daunted, he gathered some limpets, and, breakfasting off these, began his work in earnest.

THE TOILER OF THE SEA AND HOW HE MATCHED HIS WITS AGAINST NATURE

In one of the caves Gilliatt rigged up a rude forge with stones and material from the wreck. For he was no mere fisherman; he had all the resource and ingenuity of one born to outwit Nature with the invention of the engineer. His life as a fisherman and sailor had taught him how to do things in the simplest and most effective ways, and his natural ingenuity enabled him to invent methods of working on the wreck that made up for his lack of proper tools. But above all was the burning desire, the firm determination, to accomplish the great task he had undertaken, and so to be able to claim the loveliest of all the girls in Guernsey for his bride.

With the vigor of a giant and the industry of one who labored to save his very life, Gilliatt went about his task from day to day, supporting himself only by such food as the shell-fish about the rocks afforded. Bit by bit he took down the paddle-wheels and stowed them carefully away in his sloop. With rude saws and chisels, made from things in the wreck, he gradually cut away the decks and planking of the Durande, until her precious engine was exposed.

Seated on the rock with folded arms and anxious face, he now pondered over the greatest task of all. How to transfer the machinery from the wreck to his own sloop? He knew that if he could but lift it as one mass there would be room for it aboard his boat. With powerful tools it would have been an easy task, but without a single appliance of any power it meant a feat of engineering.

THE LABORS OF A TITAN AND HOW A FISHERMAN PERFORMED THEM

Four great beams of wood which he had saved from the wreck now came in handy. Hoisting these up by means of the capstan, he managed to wedge them between the two pillars of rock above the remains of the vessel. They were thus like the beams across a workshop roof, and from each one of them he hung a hoisting tackle. His next movement was to cut four holes in the deck on the starboard side of the engine, four on the port side, and a hole corresponding to each of these through the keel. Cables were then passed through the deck-holes, through those in the keel, and carried across the bottom; then upward through the holes on the opposite side, and back to the hoisting tackles. All four tackles, with their cables, were now brought together at one point of the beams, and held by a single tackle, so that one hand could control the lot.

The heroic labors of the fisherman were still far from being finished, though the progress he had made was worthy of a Titan. For more than two months had he labored at his wild and strange task all alone. No one would have known him, so terribly had he changed as a result of his toiling in the sea. His beard had grown, his hair was long, all over him were cuts and bruises. His food had been nothing but shell-fish, his only fresh water the rain and dews, that gathered in the crevices. Hunger

was ever gnawing within him, thirst seemed to have him always by the throat, and he suffered all the time from cold.

HOW THE ENGINE WAS TAKEN OUT AND LOADED ON THE FISHERMAN'S BOAT

Only the fact that Gilliatt had an intelligence far superior to that of the ordinary fisherman could have kept him at his terrible task. The sufferings to be endured from day to day would have daunted even a brave man, and in his unequal battle with the sea, only the inventor's delight of seeing his plan succeed held him to his task—that and the quickening hope that one day soon he would return to St. Sampson, a man of note for his achievement, and have the most charming girl in all Guernsey for his wife. Thus was he buoyed up in his work, and so he toiled along, enduring his hardships for the sake of the prize he now saw coming nearer day by day.

It was only after enormous toil and by fixing a series of great spikes into the rock, to which he attached some immense pieces of the wreckage that made a sort of swinging gate across the narrow defile between the two pillars of rock, that Gilliatt ventured to bring round his sloop from its safe anchorage to this perilous position below the wreck of the Durande. His plan was now to guide the great mass of machinery and planking, which was held suspended by the cables from the beams, on to the deck of his stout and capacious sloop.

How this was done it is difficult to tell, and for a moment it looked as if all his ingenuity would only result in the foundering of his sloop; but, to his great joy, the straining pulleys ceased to creak, the cables slackened, and the engine was safely deposited in the sloop.

GILLIATT'S LAST GREAT BATTLE WITH THE WAVES AND WINDS

Gilliatt had but a brief time wherein to contemplate with satisfaction the success which had crowned the labors of his brain and hands. There was a sudden stirring of the waters, a rising of the wind, heralding the coming of a tempest, long delayed. Once more had Gilliatt to prove himself a giant toiler. His first care was to swing his gate across the defile and lash it securely with chains and cables. Then, swimming and wading to the outer rocks, he threw up, by means of beams and chains, a rude breakwater, so that when the tempest broke in its fullest fury on the Douvres rocks, his sloop with the precious engine aboard would have at least the protection of the gate across the defile and this rough breakwater.

When the tempest let loose all its mighty forces of wind and rain and lightning on the Douvres, it found a weird and haggard figure of a man ready to do battle with it. And for twenty long and raging hours did Gilliatt match his wit against the brute fury of the elements. Now, by breaking down some part of the wreck, he made a barrier at the other end of the defile; again, by dislodging a massive piece of rock with a beam, and letting it roll into the seething waters, he just saved his breakwater from ruin.

At last the tempest ceased, almost as suddenly as it had begun. The blue sky was above him again; Gilliatt had won in his battle with the waves and winds. So, lying down on the deck of his sloop, he slept from sheer exhaustion, and when he awoke it was to realize his great hunger rather than to rejoice in the successful issue of his toils.

A STRANGE ADVENTURE IN A WEIRD CAVERN OF THE SEA

Stripping himself to the waist, he left his boat and climbed on the lower part of the reef, where he saw a large crab go under a great shelf of rock. Putting his knife between his teeth, he crawled after it, and, to his amazement, found himself in an underground cavern where he could stand up.

It was a weird and mysterious place, the existence of which in all his days upon the rock he had never before suspected. There, in the centre of it, was a strange, uncanny pool of green cold water, whence great pillars of rock arose and disappeared in the gloom above. All around him were the waving leaves and tendrils of strange sea growths. It was a place to strike dumb terror to the heart of the bravest. But Gilliatt was undaunted, and his hunger goaded him to find the crab that had led him there.

Wading into the water of the sullen green pool, he was groping about in the rock crevice where the crab had disappeared, when suddenly he felt his arm seized by some living thing! Around

his naked arm he felt this thing twisting, rough and flat and cold and slimy. It was creeping up towards his chest, tightening like a cord. He tried to pull away a little, but found that he could scarcely move, as the thing that held him was as supple as leather, strong as steel, and icy cold.

THE FISHERMAN'S FIGHT WITH THE GIANT CUTTLEFISH

Then from the hole in the rock whence this mysterious thing had come there came another that wound itself about him, creeping over his skin with innumerable flat, round points that stuck to him like suckers, and caused a strange sense of pain.

From the crevice of the rock there came another, and yet another of these awful living thongs, that bound him helpless, and a fifth had fastened on him before he could dimly see the horrid shape of the monster, with its two great eyes set in the middle of its short and pulpy body. He was in the grasp of a great cuttlefish, or devilfish, as it is sometimes called.

Its tentacles held his right arm powerless, and it was advancing towards him, with its parrot-like jaws ready to fasten on his side. Then, indeed, there had been an end of Gilliatt and his plans; but, with a rapid sweep of his free hand, in which he had his knife, he quickly severed the hideous head of the uncouth creature, and immediately he felt its tentacles relax.

He had freed himself, and was about to flee from this cave of terror, when he noticed, partly buried in a heap of crabshells, a skeleton with a belt around its waist. He pulled at this, and as it fell apart he found himself with a small iron tobacco-box which enclosed some pieces of paper.

THE TOBACCO-BOX THAT GILLIATT FOUND IN THE CAVE ON THE DOUVRES

They were the three thousand-pound notes. This had been the end of Clubin! Gilliatt's knife had enabled him to escape the same terrible death.

It was two days later that Gilliatt arrived in the dusk at St. Sampson, and moored his boat close by the house of Mess Lethierry. All that he had hoped to do was done. He had achieved what others had believed to be the impossible. He had suffered, he had won. Yet nobody knew he was there. He went very quietly to peep into the garden, where he hoped to see Deruchette. There she was, but not alone. There was a stranger with her, who held her in his arms, and she seemed to love him. Poor Gilliatt saw this, and moved away without a word.

Nothing can describe Lethierry's delight next day when he realized that the precious engine of the Durande had been salved. He behaved like a man possessed. There was nothing too extravagant for him to say of Gilliatt. The man who saved the engine was to marry his Deruchette, and he meant it. But he did not know what Gilliatt had seen. He did not understand why the young fisherman said "No!"

And so it came about that Deruchette was married to the man whom Gilliatt had seen with her in the garden on his return. They sailed away from St. Sampson, and, standing on the deck to take a last look at the old town, she said to her husband:

"Look! It seems as if there were a man out there on that rock."

GILLIATT'S LAST SIGHT OF DERUCHETTE AND THE END OF IT ALL

There was, indeed, a man upon the rock, sitting motionless, as the vessel passed out from the harbor, and the man looked wistfully towards the lovely face of Deruchette. Many a time before had he sat in that same place. It was a sort of natural chair hollowed out of the rock by the action of the sea, and at high tide the water rose above it. Gilliatt, in the old dreamy days, had often sat there gazing out to sea, dreaming, until the rising tide warned him to be off. The water was rising now, but he did not heed it. The waves had reached the waist of the man when Deruchette drew her husband's attention to him. The water was now nearly level with his shoulders; but his eyes were fixed seaward on the diminishing vessel, and a strange light shone in their profound and tragic depths. One could read there the melancholy acceptance of an end far different from the dreams the man had cherished

The vessel had become a mere speck now on the horizon, and when it vanished the head of Gilliatt disappeared altogether. Nothing was visible but the far-gleaming sea.

THE NEXT FAMOUS BOOKS ARE ON PAGE 4315.

If the sun's rays be passed through a slab of ice shaped like a burning-glass, the heat waves retain their heat although the ice is so cold, and will light a fire of paper and wood, as shown here.

DIFFERENT KINDS OF HEAT

CONTINUED FROM 4088

WE have discussed the first great fact about heat, which is that it is a particular kind of motion of the particles of matter, and therefore we must be able to imagine that matter might exist without this motion—that is, absolutely cold. This discovery of the nature of heat is one of the great discoveries of modern knowledge.

But now many of us who have read so far will want to ask a very serious question, because we see very well that either something has been missed out from what we are saying, or else words are being used with very mixed-up meanings. What we ought to ask ourselves is this: Seeing that heat is a particular kind of motion in matter, and that when we get outside our ocean of air there is no matter between us and the sun, what is that heat which the sun sends us?

The reason for the difficulty, as we have already mentioned, is that the word heat is being used with mixed-up meanings. When we look at the facts, we shall see that there is much excuse for the confusion, but still it is a confusion. We have to admit at once that the word heat is used for two different things—first, for a particular kind of to-and-fro motion in matter; and, second, for a particular kind of wave in the ether. So now, before we go on to any details, let us look in a general way at this other kind of heat, as we have done in the case of the first kind of heat. The rest will be all plain enough if we get right ideas at the start. For the moment, let us quite forget what we know about the heat which is a motion in matter; or, if we do not forget, let us assume that the word heat is now being used as a quite different word.

Everywhere there is the ether. Throughout all space, whether matter is there or not, there is the ether, that can be thrown into waves. These waves are of different shapes and sizes, but they are all of the same nature, and all travel through the ether at the same rate. Different parts of our bodies pick out certain sets of these waves, and then we call them by special names. For instance, our eyes pick out a group—not a very large group—of these waves, and see them; those waves, then, we call light waves.

Close to them in the great scale of ether waves are others, really of just the same kind, which, as it happens, our eyes are unable to see, and which, therefore, we do not call light. But other parts of our body can feel them, and the feeling they give us is one of

warmth or heat. So we call them heat waves. If we use the modern term, which is being employed more and more, we shall say that the ether conveys *radiations*. In the mighty scale of the ether radiations, which we may compare with a series of notes on a piano, the heat radiations lie just below the light radiations. The two are in all essentials the same; they differ only as one octave on a piano differs from an octave next to it. Radiant heat and radiant light both travel through the ether at exactly the same speed—namely, about 186,000 miles a second. They come together to us from the sun.

SOMETHING THAT THE THERMOMETER CAN FEEL WHICH OUR EYES CANNOT SEE

It is possible to spread out the radiations from the sun by passing them through a prism—a three-sided piece of glass. When this happens, the radiations are all spread out in their proper order, and if we take a thermometer it is very easy to show that on one side of the patch of light which passes through the prism, and in the darkness just beyond it, there is something which our eyes cannot see, but which the mercury in the thermometer can feel, so to speak, and that is the radiant heat coming from the sun.

Now, we shall best understand the uses of the word heat, and the way in which things really happen, if we trace the course of things from the sun, say, to our own skin, when the sun's warm rays fall upon our faces. Let us suppose, for the moment, that we are blind, or have our eyes shut; we are not to consider the light waves at all, but only the heat waves.

The sun is made of matter; and the matter of the sun, like all other matter, is made of atoms and molecules. These, in the case of the sun, are intensely hot. We should have to represent their temperature at thousands of degrees.

MOVING ATOMS IN THE SUN THAT CAN KILL A MAN ON THE EARTH

Now, we already know what this means. It is that the atoms and molecules of the sun are moving very quickly to and fro in a special way which makes heat. The question is: How does that movement, more than ninety millions of miles away, affect us? For, walking on the earth, we may be actually killed by sunstroke, because at that immense distance certain atoms and molecules are moving very quickly backwards and forwards. This can be explained, and the explanation applies equally to the case of the sun, or to the case of a warm fire which sends across the room heat that we can feel.

We are to remember that the ether is everywhere. Let us for the moment think of it as an ocean in which everything is buried—the sun and the earth, and everything else. Now, the atoms and molecules in the sun or in the fire, as they move quickly to and fro in this ocean of ether, may very well start waves in it, just as a fish's tail would start waves in water. And those waves are the radiant heat which travels through millions of miles in the ether from the sun in every direction equally, and of which a very tiny proportion is caught by the earth and the people upon it.

Fortunately for us, before these powerful rays reach us, a very great quantity of them is stopped and kept by the atoms and molecules of the air which floats above us. None of us could possibly survive the sun's glare if there were not an ocean of air above us to catch a great deal of it.

THE WAVES OF ETHER FROM THE SUN THAT GIVE US HEAT

Now, what happens when the air, or anything at the bottom of the air, such as a stone or a sheet of water, receives these rays from the sun? The wave has traveled through the ether from the matter which made it, and has struck other matter. In that matter it produces the same kind of motion as that which made it in the first place, and so the heat of the matter of the sun produces heat in the matter of the earth.

It has probably not been pointed out before how close is the parallel between what happens in this case and in the case of the telephone. When we speak into the telephone, certain to-and-fro motions are made in the matter there, which we call the drum. These motions do not run along the wire, but they produce in the wire an electrical wave which is not really a wave in the wire at all, but in the ether in the wire, and which is really of the same kind as a wave of light or of radiant heat. At the other end of the telephone there is another drum, which is made to vibrate to and fro like the drum into which the words are spoken. Just

in the same way, the ether waves that are started by the hot matter of the sun strike the matter upon the earth, with the result which we call heat. We have a very good instance of this when we use a burning-glass. We know that if we have a rounded piece of glass, we can make it throw a bright spot upon a piece of paper, and that we can even cause the paper to burn in that way. The glass has acted not only upon the light waves, which we can see, but upon the heat waves, which we cannot see; and when the paper is thus heated to a sufficient degree, it combines with the oxygen of the air, and we say that it burns.

In these last sentences, the word heat has been used in its two senses; but we have now studied the subject far enough not to be confused, and we understand the very great and complete difference there is between that special motion of the atoms of the paper which we call heat, and those waves of the ether which are a kind of invisible light, and travel through millions of miles of space where there is no matter.

THE KIND OF HEAT THAT MOVES IN MATTER IN TWO DIFFERENT WAYS

Here, it is not necessary to say any more about radiant heat; but of course we shall have to refer to the important subject again when we come to study light. Now let us go back to the heat which is a motion in the atoms or molecules of matter, and which might indeed, to distinguish it, be called atomic or molecular heat.

This kind of heat, as we have all observed for ourselves, can travel about in two ways, and now that we know what it is, there is no difficulty at all in understanding how it travels. Let us take the case of the water in a kettle which is being heated.

We can imagine the special kind of motion called heat being imparted to the molecules of water that lie nearest the bottom of the kettle. It may then be, as indeed it is, that these molecules rise to the surface of the water, and as they rise of course they carry with them their heat. Now the heat which was applied to the under surface of the water has reached its upper surface. It has been bodily carried, so to speak, through the water; and when heat is carried in this way we say that this is a case of *convection*. This is an uncommon but quite simple word, if we remember the word vehicle. These two words come from the Latin *veho*, I carry; and so convection, or "carrying with," exactly expresses the way in which heat travels when hot particles moving about from one place to another carry their heat with them.

MATTER THAT CARRIES ITS HEAT AS A BEE CARRIES ITS BUZZING

We may think of this, perhaps, if we care to, as like the case of a buzzing insect. The buzzing and humming are due to the vibration of its wings, and as it flies about it carries the buzzing and humming with it. So we may think of the molecules of matter as buzzing. That buzzing is their heat, and when they travel of course they carry it with them. If we think of it in this way, we shall not be confused when, in a little while, we go on to study another way in which heat travels.

Convection of heat is an extremely important subject in our lives, and in the Story of the Earth. We understand, of course, that it applies only to fluids—that is to say, liquids and gases. In them the matter is flowing, and so it can carry its heat with it; but in anything solid the atoms and molecules stay in their places, even though they may be very hot and vibrating to and fro very quickly in their places. So no convection of heat occurs in solid bodies, but in all fluids convection currents are practically always going on. This well-known fact works out in a thousand different ways.

HOW OCEAN CURRENTS AND THE CURRENTS OF AIR ARE CAUSED BY HEAT

In the case of the water in the kettle, the heated water rises. It does this because heated water is lighter than cold water. Therefore, by heating one part of the body of the water, we can set the whole body of the water moving, and this applies not only to the kettle, but also to the oceans. It applies equally to other fluids, such as the atmosphere. In all the water of the earth, and in the earth's great coat of air, different parts are at different times heated more or less than other parts, and so convection currents are started. The results are very important, not only because heat is carried about from place to place, but because the matter

carrying the heat is also moving about. In this way great ocean currents, and also great air currents, which we call winds, are started. There are constantly going on, for instance, what are called the trade winds, so called because in the old days, when ships were driven by the wind, the ocean trade of the world largely depended upon them. These trade winds depend entirely upon the laws of heat which we are now studying. If we think of the earth as a whole, we shall see that the tropics, being more directly exposed to the sun, are heated more than the temperate zones.

The air of the tropics, then, being heated and made light, ascends, carrying with it its heat. But as it ascends it leaves a space beneath it, and that space is filled by colder and heavier air flowing in to take its place. So there is set up a wind blowing from the north towards the tropics, and also one blowing from the south towards the tropics. If the earth were stationary and did not spin, these winds would be due north and south; but the earth is spinning, and any point at the tropics is moving round much faster than any point in either of the two temperate zones.

THE MEETING OF THE WINDS THAT USED TO CARRY THE TRADING SHIPS ALONG

This means that the apparent direction of the wind is altered, owing to the spinning of the earth, and, in consequence, the trade winds are not north and south, but in the northern hemisphere they are north-east, and in the southern hemisphere they are south-east. The two winds meet along a belt round the middle of the earth, and in the old days when ships got into this belt, where the two winds meet and cancel each other, so to say, sailors might be becalmed for long periods of time. The trade winds, though at one time important, are of practically no importance now, but the study of them in relation to the laws of heat is very interesting.

Now let us consider this law of heat as it affects the ocean. Here is a fluid of which the different parts can move freely, and they will carry their heat with them by what we have learned to call convection. The hotter water will rise because it is lighter, and cold water, which is heavier, will flow in underneath it, just exactly as we have seen in the case of the trade winds, in that other ocean which we call the air.

The consequences in the case of the ocean of water are very important, for the laws of heat so work out in this case that cold water, which was near the surface in the Polar or even the temperate regions of the earth, but especially in the Polar regions, travels towards the warmer regions of the earth, but is compelled to sink as it does so, having above it the warmer water, which has been exposed to the heat of the sun in the far warmer zones.

THE EVER-MOVING STREAM OF COLD WATER THAT GIVES LIFE TO THE OCEAN

Thus, in the great circulation of water on the earth which is always going on, we have to think of something rather like running a stream of cold water into one end of a bath filled with hot water. The cold water simply creeps along the bottom. Now, that is what happens in the case of the ocean, and the enormous importance of this fact is that the life of the deep-sea fishes, and the life —animal and vegetable—everywhere covering the ocean floor, depend entirely for their existence upon this stream of cold water. When it was at the surface it obtained oxygen, and that oxygen, which it carries to the depths, sustains all the life there.

One more instance of the convection of heat is, perhaps, the most interesting, and is certainly, in some ways, the most important of all. It is not to be found in any of the ordinary books on this subject, perhaps because most of the people who study these subjects confine themselves to studying only one view of them. If we examine our own bodies, or the body of any warm-blooded animal, we find that their temperature, or warmness, as we may say, is nearly the same at all parts.

THE BLOOD THAT MOVES IN OUR VEINS AS WATER MOVES IN THE SEA

Now, we know that the heat is not made in, for instance, the hands or the feet, but only in certain organs in the inside of the body, and in the large muscles when they are thrown into action. How, then, is the heat distributed, so that the whole body is kept warm? The answer is that the circulation of the blood, wonderful in a hundred other respects, also supplies a beautiful

instance of the convection of heat. The outlying parts of the body could not be kept nearly warm enough without this process of convection, for they lose heat to the outside world far more quickly than it could be received by that process. But the blood, which rapidly travels throughout the whole body without ceasing, carries to the surface and the limbs and other exposed parts, such as the ears, not only oxygen and food, but also heat, and then, as it flows through the small blood-vessels in these parts, the heat which has been bodily carried there by the blood leaks through into the tissues and keeps them comfortably warm.

HEAT THAT IS ALWAYS PASSING TO AND FRO BETWEEN DIFFERENT THINGS

Now that we perfectly understand the convection of heat, we can go on to study another of the very important ways in which it travels, and that is what is called *conduction*. The conduction of heat occurs in all circumstances, in solids, liquids, and gases, from solids to liquids, from gases to solids, and so on.

It is the constant law, true everywhere and always, that, whenever one thing is hotter than another, heat will flow from the hotter to the colder. Just as we say that water must find its own level, because of the constant action of the earth's gravitation, so we may compare heat with water, and say that it must find its own level. The constant tendency of heat everywhere is to make its level equal. Every portion of matter everywhere which is hotter than its surroundings must lose heat to them, just as a river must run downhill.

HOW A ROW OF BOYS CAN SHOW THE WAYS IN WHICH HEAT TRAVELS

Now, we must first understand what conduction actually is, and how it differs from convection. In conduction, the heat is passed on, or conducted, but the matter which contained it stays where it was. It is like a row of boys in which each one is slapping the next; whereas, in convection, the boys would change places and take their slaps with them. If we remember what heat is, we can begin to imagine how the buzzing, or vibration, of the atoms at one end of a poker might start the atoms farther along vibrating also in the same way, and so the buzzing, or heat, would be conducted along the poker. It is not possible to go more deeply into the nature of conduction than this, because we really do not know how the atoms or molecules of matter are held together, in a poker or in anything else.

But we can, at any rate, study conduction in many ways, and the first thing we find is that different kinds of matter vary enormously in their conduction of heat.

Everyone knows that one end of the poker becomes hot when the other end is held to the fire. Yet one end of a piece of firewood may be so hot as to be actually burning, and the other end quite cool, though the stick is far shorter than the poker. The metals in general are very good conductors of heat, as the iron of the poker suggests. On the other hand, tissues made by living things are very bad conductors of heat. Wood is such a tissue, though we do not always think of it as if it were, and we have noticed how badly it conducts heat. Bone, also, and wool and silk, and even linen and cotton, always conduct heat very badly.

WHY IT IS NECESSARY FOR THE BLOOD TO CIRCULATE IN OUR VEINS

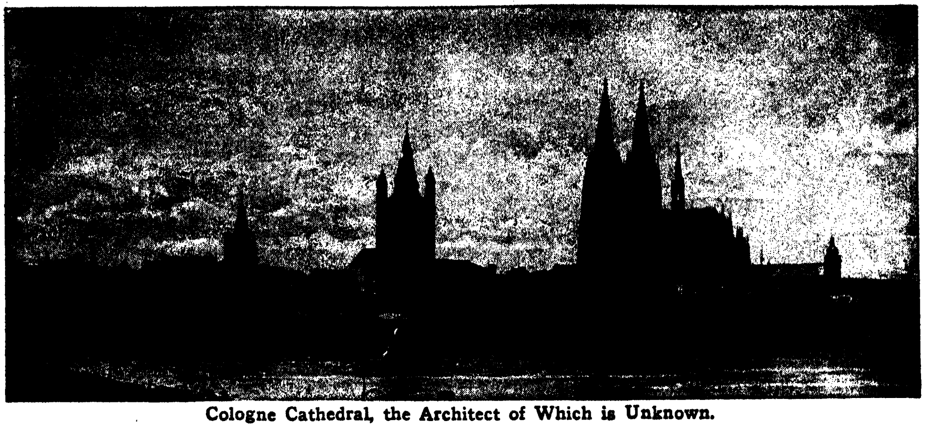
This general fact about the tissues of living things shows us how necessary it is for the circulation of the blood to play the part we have just studied, for our bodies are such bad conductors of heat that the heat made in the liver and muscles could not keep the whole body warm if it were not that convection is called in to the aid of conduction—first, we have quick convection by the blood, and then we have conduction through the finest blood-vessels to the tissues.

Though we have to rank the group of the metals as good conductors, yet even among themselves, they vary a good deal. Those which conduct heat best are those which conduct electricity best—for instance, copper and silver. The fact that living tissues conduct heat badly is by no means a disadvantage; it is a matter of the greatest importance to all warm-blooded animals that they are able to produce, by the life that is in them, special kinds of tissue which are very bad conductors of heat, and with which they clothe themselves.

THE NEXT PART OF THIS IS ON PAGE 4309.

THE RHINE ON ITS WAY TO THE SEA

Water gives us some of the most beautiful pictures in the world. This striking scene is a photograph of one of the mightiest rivers in Western Europe, the Rhine, in Germany. A photograph taken from the same spot one second later or one second earlier would be entirely different, so rugged are the rocks over which the river rushes on its way from the highlands into the lovely valley that it has carved for itself on its way to the sea. To sail along the Rhine is one of the greatest pleasures a traveler can have, so fertile and beautiful has this great river made the country through which it passes. (Photograph by Ballance.)



Cologne Cathedral, the Architect of Which is Unknown.

LEGENDS AND TALES OF THE RHINE

CONTINUED FROM 4126

THERE are many rivers larger and longer than the Rhine, and perhaps some are more beautiful, but no other river has so many stories and legends connected with it. Every hill or mountain, cliff or castle, has its own particular story. Some of them are true, but often they are merely interesting legends or tales that have been passed on from one generation to another.

THE LEGEND OF DRACHENFELS

An interesting legend is attached to Drachenfels, or the Dragon's Rock, which is situated on the right bank of the Rhine. Half way between the base and top of this crag was a dark cavern, known as the Dragon's Cave. Here dwelt a hideous creature, half beast and half reptile, which ate nothing but human flesh. The pagans in their ignorance worshipped the dragon, and often gave as food to the dragon the Christians they captured from the opposite bank of the Rhine. Two pagan princes, Ronsik and Horwald, were accustomed to divide their captives, each one sacrificing a certain number of human beings. One day, while at this task, they noticed a beautiful Christian maiden who won the hearts of the princes by her charm and helplessness. Each wanted the maid, not as a sacrifice to the dragon, but as a wife. They quarreled fiercely but finally decided that it was not dignified to quarrel over a mere girl. It was then decided to offer the maid as a sacrifice to the dragon, and the following morning was chosen as the time for the ceremony. When the maid was told of her fate she prayed for strength to meet her end. Early next morning the princes and all the people in the neighborhood escorted the girl to the Dragon's Rock and waited impatiently for the monster to appear. Ronsik watched the maiden with pity, for he loved her, especially since she was willing to meet her fate so bravely. Suddenly a loud roar was heard and the dragon rushed forward to seize his prey; but as he advanced the maiden held out her crucifix, and with a piercing cry, the dragon turned aside and plunged into the Rhine.

The people, astonished at the power of the cross, begged to be converted to Christianity. Among the first to adopt the Christian religion was Ronsik, who married the maid and built a home for her on the Drachenfels, which is now known as Castle Drachenfels.

This cave has another story. If you

have read the story of Siegfried you remember that he killed a fierce dragon. People used to believe that Siegfried's dragon also lived in the cavern in this mountain.

EBERNBERG

You will be surprised to hear that Ebernberg means castle of the wild pig, but when you learn the reason for this strange name, you will surely understand. On a steep cliff not far from Kreuznach, there stands an immense castle. Many years ago, the lord of the castle, upon awakening, found his castle surrounded by enemies. The count knew that they could not capture his home, because the moat, or deep ditch, surrounding the castle, was too steep and the walls too thick and high; but they could prevent the people in the castle from procuring food.

The siege lasted for many days and finally starvation for all was near. The count finally went into the stable and brought out a wild pig, which he had caught alive. Taking the pig to the outer wall he pinched and pricked the animal until it began to squeal. He did the same every day until a week had gone by. The enemy, hearing the squealing every day, said: "We can never starve them out, they have too many pigs." Discouraged and disappointed they went away. The wild pig had saved the castle.

RHEINSTEIN AND REICHENSTEIN

The castles of Rheinstein and Reichenstein are situated very close to each other and there is an interesting story connected with them.

Many years ago Rheinhard of Reichenstein was deeply in love with the beautiful Hinda of Rheinstein. Now Hinda's father was very wealthy, but Rheinhard had only a small castle and very little money. Nevertheless he presented Hinda with a beautiful ruby, which had been in his family for many years. The maiden seemed very much pleased, and finally the young lord, unable to restrain himself, declared his love to the golden-haired beauty. She promised to marry him just as soon as her father consented to the match.

According to the custom of the times, it was necessary for Rheinhard to send as an embassy to the castle of Rheinstein, one of his most distinguished relatives. Now the only kinsman anywhere near was a wealthy old uncle, Ludovick by name. This false old man was delighted to go to the court of Hinda's father, but when he arrived there, instead of demanding Hinda's hand for his nephew, he declared his intention of marrying her himself. Hinda was in despair because she wanted to marry her lover and hated the uncle. Her father, however, wanted her to marry Ludovick because he was powerful and wealthy.

"I will marry no one but Rheinhard," the maiden declared, but her father was proud and stubborn. "You shall marry the man I choose for you, and you may as well make up your mind to that," answered the father, and considered the matter settled.

The next day was set for the wedding ceremony and the fair Hinda looked beautiful in spite of having spent a sleepless night. Seated on a spirited steed, she rode next to her father on her way to church. Just in front of that building, she spurred her horse, and the nervous animal plunged forward. She directed him toward her lover's castle. Ludovick attempted to follow her, but just as Hinda's horse arrived at Reichenstein, the old man's horse stumbled and both rider and charger fell over the precipice and were killed. Rheinhard was his uncle's heir and inherited all his money and became lord of his vassals. The lovers were married and, as far as we know, lived happily ever after.

THE MOUSE TOWER

About the tenth century the people around Mainz had a very rainy summer. It rained constantly and when autumn came there was no harvest. The wheat and corn had rotted in the fields, and during the winter the poor people had nothing to eat. Bishop Hatto alone had a large supply of grain left over from the year before. Every day the starving poor crowded around Bishop Hatto's door, begging and pleading for some corn. At last the bishop appointed a day when all the poor should come to his barn and receive as much grain as they wanted. The people rejoiced at this good fortune, and when the day came the barn was filled with poor folk, women, children and men, young and old. When the barn was so full that it could not possibly

hold any more, the wicked bishop shut the doors, set fire to the building, and burned all the people. The cruel man watched the fire and compared the shrieks of the people to the chattering of rats. After the entire building had burned to the ground, the bishop returned to his palace and after dining happily, slept as if nothing had happened. The next morning as he entered the main hall he noticed that the rats had eaten his picture out of the frame. A cold shiver passed through him and he knew that this was not the end of his trouble. From that time there was a plague of rats about him. They ate the food, gnawed the clothes and furniture and grew bolder and bolder. One day the bishop heard his farmer shout, "Fly, go away as fast as you can, for many thousand rats have eaten your corn and they are now coming this way. You are going to be punished for your sins at last."

"I am not afraid," answered the bishop, "for I shall go to my tower on a rock in the Rhine, where no rats can possibly reach me." Without delay he crossed the Rhine and entered this tower which he had built. Barring the doors, he thought that he was safe. He was soon disappointed, for thousands of rats swam the river, and soon they could be heard climbing the tower. In a few minutes they had entered by every window and every crevice, and had devoured the cruel bishop. The Mouse Tower, as

Rheinstein is one of the best preserved of all the German castles, as well as being in one of the most picturesque locations. Below and to the right you can see the winding river at the foot of the steep cliff.

it is usually called, may still be seen on an island near Bingen.

THE BROWNIE AND THE FARMER

On a cold day in midwinter a poor farmer was painfully making his way through the forest near Seegburg. The ground was slippery and almost impassable, and the man had to stop very often to get his breath. It began to rain and the farmer's hands and face were red and cold. Hardly able to walk any further, the man looked imploringly to the sky for help.

"Hello, old farmer," a voice suddenly called. He looked around but could see no one.

"Here I am," was heard again and behold, under a root, a brownie was crouched on a hazel nut. Can you imagine how small was this little man, if he was able to sit on a hazel nut. He was leaning his head on one hand and stroking his long gray beard with the other.

"Are you very cold?" the tiny voice asked again.

"Of course, since I am not sitting under a root as you are."

"Your leathern breeches are too thin."

"They are too old."

"How old?"

"Oh! my grandfather left them to me, and I have not money enough to buy another pair."

"You poor man, I will give you a pair of my breeches," volunteered the little man. The farmer thought it was a great joke to think that he could wear the trousers, which apparently were not large enough to fit his finger. Nevertheless to please the brownie he tried to put on the breeches and behold, they fitted him as well as if the best tailor had made them.

"Thank you ever so much," said the farmer, and turned as if to depart.

"Wait," shouted the brownie, "where are you going?"

"I am going to the city to buy three pennies' worth of bread for my wife and seven children."

"Put your hand in your pocket and see how much money you have now." Astounded, the farmer pulled out six pennies.

"See," said the brownie, "your money will be doubled every time you count it, and you can soon become a rich man. Remember, never wear another pair of breeches, no matter how rich and powerful you may become." The farmer wanted to thank the brownie again but the tiny creature had disappeared.

The man now began to count his money and soon he had as much as he could carry. He hurried into town and bought bread, cake, meat and wine. Imagine the joy of the wife and the seven children. The farmer, industriously counting his gold, soon became the wealthiest man in the neighborhood. He built a magnificent palace and had a large store room filled with gold. Naturally enough, many of the dukes and kings who visited the palace wondered why the wealthy man wore such shabby leather breeches.

Finally the rich man thought, "It is a shame for one so powerful to wear such breeches. I will have them washed and then perhaps they will look better." The washerwoman hung them on a fence to dry and suddenly a strong blast of wind blew the breeches away. This of course was the work of the brownie. The next day when the man counted his money he found the same amount as the day before. Alas! his money no longer was increased, but don't feel sorry, for he still had a great deal.

ST. GOAR

Now Goar was a good religious man who came to the Rhine to make people happier. First he gave them religious instruction, and then gave them good things to eat. He taught them how to catch salmon and cook them, taught them to plant grape vines and to press wine. So of course you will not be surprised to hear that the people called their new town St. Goar. The good man was happy here, and when King Siegbert offered him a bishopric he declined, preferring to live with the people who loved him. If you chance to visit St. Goar, on the Rhine, you will see the grave of the man who aided the people of the Rhine. Countless legends are related about this holy man.

THE FOUNDING OF MAINZ

Fourteen hundred years before the birth of Christ there lived in the town of Treves, a magician called Reemug. He performed so many tricks, and annoyed the townspeople to such an extent, that it was decided to chase the wizard from the town. They pushed him through the

gates of Treves and shouted: "Leave here at once and go to the place where the pepper plant grows." The magician shook his fist and cried:

"Wait! You shall regret this, for I will build a city near here finer and more beautiful than Treves."

Instead of going to Borneo, where the pepper plant flourishes, he went to the Rhine, and by his magic caused a city to appear, at the place where the river Main flows into the Rhine. He called this city Mainz and it is now a larger city than Treves. Of course this tale may not be true, and you are privileged to doubt it, if you wish.

THE FEARLESS LOVER

In the town of Worms there stands an old castle known as Wampolder Hof. The keeper, or castellan, of this castle had a very beautiful daughter, who was so charming and lovely that all the youths in the neighborhood loved her and desired to marry her. For one only among all her lovers did the maiden cherish affection; and this youth was handsome, courteous, and of noble birth. They were betrothed, and all seemed well for the young couple.

One Walpurgis night, the time when the witches and goblins fly down from the mountains on their broomstick steeds, and make hideous noises, all the maidens and youths were assembled making merry and telling weird stories. Suddenly the daughter of the castellan said to her betrothed, "If you love me as you profess, go to the crossways, watch the procession of witches, and come back here to tell us what you have seen." Not wishing to seem cowardly the noble youth consented, and left the merry company.

One o'clock, two o'clock, three o'clock, and still the lad did not return. Frantic, the maidens and youths went to the crossways, but no one was there, and the youth was never seen again. The keeper's

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Little is left of Castle Drachenfels, but there is enough to show how large and how strong it once was. It has been visited by thousands of tourists from all parts of the world. It is on the east bank of the river.

daughter, realizing her mad act, killed herself. Some said that her lover had been torn limb from limb by the angry witches, and his remains scattered to the winds; others say that the witches took him to their cave in the mountains. On Walpurgis night the castellan's daughter may be heard in Worms calling for her lost lover. Another story says that she may be seen in the castle, and that she must haunt it until some young man refuses to pay any attention to her, no matter how charming she seems to be.

THE ARCHITECT OF COLOGNE CATHEDRAL

When traveling on the Rhine it is customary for tourists to stop at Cologne in order to see the cathedral, one of the finest in Europe. The building is particularly beautiful and the following tale is often told.

The bishop of Cologne wished to have the richest congregation in the neighborhood and decided that in order to bring this about Cologne must have one of the finest cathedrals in Germany. The bishop at first determined to summon an architect from Italy, but hearing of a gifted young man who lived at Cologne, offered him a large sum of money if he could draw the plans satisfactorily. An architect is one who makes the plans and designs for a building before it is constructed.

The young man was delighted to receive this important commission, and immediately set to work. When he began to draw, he discovered that his talent had vanished and it was hopeless for him to proceed. He could not even draw a line. Heart-broken, the young man walked on the banks of the Rhine, trying to draw pictures on the sand. Suddenly he turned and saw a stranger also drawing a picture. This picture was a cathedral, and just such a one as the artist had dreamed of, but was unable to design. Looking carefully at the stranger, the architect noticed his wicked expression, and above all a tiny tail, which was almost concealed beneath his coat. He knew then that this was the Devil. The Evil One said, "If you sign a paper giving up all hope of ever going to heaven, I will give you the plans for the cathedral. Meet me at twelve o'clock to-night, and we will complete the bargain."

The architect, weeping, went to his priest, who also was anxious to have the cathedral built, who said to the young man: "Here is a piece of the Lord's cross, it will protect you against the Evil One."

That night true to their agreement the Devil and the architect met. The architect received the plans, but instead of signing the document he waved the relic, and the Devil, breathing fire from his nostrils, was unable to touch the young man.

"You cannot deceive me," said the Evil One, "for although you have the plans for the cathedral, your name shall never be remembered." The Devil's threat was fulfilled, for nowhere can you discover the name of the architect of Cologne Cathedral. There is a story that he lost his life while placing a stone on which his name was cut.

RHEINGRAFENSTEIN

The castle of Rheingrafenstein is perched high on a huge rock, and there is a curious story connected with its erection. A powerful lord thought that the top of the rock would make a fine site for a castle, for in case there should be war, the enemy would be unable to attack it. He soon discovered that it was impossible to build a castle on the cliff. The lord was much disappointed, and one day, the Evil One appeared and said that the castle could be built over night, if the lord gave him the first living creature who should look from its windows. The nobleman agreed, and the next morning, a beautiful strong castle stood on the heights. The lord was afraid to enter the palace, but his wife was clever, and riding ahead on a donkey, bade all follow her into the castle. When she came within the gates, she tied a cap on the donkey and drove the beast through the door. It went to a window and looked out. The Devil seized his prey, and fancy his disappointment when he found it was a donkey. He dropped the donkey on the rocks below, and vanished from the district, never to return.

These are only a few of the many stories of the Rhine, and its castles, rocks and caves. Sometimes the same story is told with different names, and sometimes there are two or more stories which give different explanations of some ruin, or some great natural curiosity.

THE NEXT STORIES ARE ON PAGE 4279.

WHAT THIS STORY TELLS US

WE think of stone as having always existed, and the stones of the earth were made a very long time ago. Man is making stone every day, however, and you have probably seen it many times. This story tells how a mixture of Portland cement, sand and pebbles may be poured into any shape, and how it gradually becomes solid stone. Few discoveries have been more important than that limestone or marl, heated with clay and ground to powder, makes a substance which is as strong as most stones, and can easily be made into any form desired. Every year concrete, as the mixture is called, is used more and more in building houses, streets, bridges, floors and dozens of other things.

HOW MAN MAY MAKE STONE

CONTINUED FROM 4182

ALL of you have seen walks, walls and steps that looked like stone, but were not stone. Perhaps you have seen men making them, but did not understand how a mixture of gray powder, sand, gravel and water could make a stone as hard as that that comes out of the earth. This story is to tell you how it is done.

First you must know that making stone is not a new idea. The old Romans made it, and some of the things they made are strong to-day, after nearly 2,000 years. Men soon learned that when lime was made wet and allowed to dry, it became hard. Since lime was sometimes hard to get, they found that it was still strong when mixed with sand. This is the common mortar which holds together the bricks in a wall. This mortar is a kind of stone. Later men found that if they mixed lime with other things they had a still stronger substance.

HOW PORTLAND CEMENT GOT ITS NAME

An Englishman burned limestone and clay together, and ground them into a fine powder. He found he had a substance which, mixed with water and allowed to dry, was as hard as some popular building stones. Because the blocks he made looked like the sandstone which came from Portland, he called it Portland cement, and this name is used everywhere, though it has nothing to do with Portland.

All that is needed to make Portland cement is to burn a limey substance with a clayey substance and to grind the result into a powder. In England they use chalk and mud from the rivers. In the United States there are many kinds of stone and clay which can be used. If the right proportions of lime and clay are put together it makes no difference what is used.

Blocks made of this cement are more expensive than bricks, and so it is not used alone very much. It was found that it could be mixed with a great deal of sand and still be as hard as necessary, and would be even better for some purposes; and then it was found that pieces of broken stone could be used in addition to the sand. This mixture, then, of cement, sand and small stone, is called concrete, which means grown together or hardened.

Now concrete is the substance of which we build sidewalks, roads, steps, foundations, walls, bridges, pipes, vats, fence posts, floors, drinking troughs, houses and dozens of other things. You can think of some of these other things if you try. Now let us see how it is done, and what happens.

WHEN A FULL PAIL IS NOT FULL AT ALL

If you put all the potatoes you can into a pail you say that it is full, but that is not quite true. You can still put in a quantity of beans which will partly fill the spaces between the potatoes. Even yet some sand will fit in between the beans, and you will find that you can still pour in some water without making the pail overflow.

Something like this happens when concrete is made.

The sand partly fills the spaces between the pebbles or pieces of stone, and the fine cement fills the spaces around the grains of sand and with the water makes all stick together. Every grain of sand must be coated with a thin paste of the cement, and the sand and cement must fit tightly around the stones. If any air spaces are left, the concrete will not be strong, and will not hold water.

Perhaps you have seen men mixing all these things together in a box on the street or at your home. Where a great deal of concrete is to be used, as when a whole street is to be paved, or when a great bridge is to be made, you will see a large steel mixer into which all the materials are poured. This is made to revolve by an engine, and to it the men come with their wheelbarrows for a load, or the mixture may be loaded into wagons or buckets.

THE MATERIALS MUST BE MIXED CAREFULLY

Do not think that the materials are thrown together without any plan. The cement is expensive, and so no more is used than is necessary, but if too little is used the work will not be strong. By experiment men have found out the quantity of each it is best to use. For some kinds of work one part of cement, one of sand, and two of stone are used. For other kinds of work another part of sand, or even two more parts, may be added, and from two to five parts more of stone. We speak of one mixture as 1:2:4. This means that one part of cement, two of sand, and four of stone are used.

The mixture is not hard when it comes out of the mixer, and so must be held in shape. This is done by forms, which are generally made of boards. If a wall is being built, boards are placed just the right distance apart, and the mixture is poured between them. In making a sidewalk boards are placed the desired distance apart and concrete is placed between them. You can make a trough by hanging one box inside a larger one, and pouring the concrete in between. The water begins to evaporate very soon and the concrete begins to set. Concrete will harden under water, however. In a few days it is quite hard and the forms may be removed, but it continues to grow harder for about two years. To make the surface smooth a thin coat of cement and sand without stone is plastered on.

STONE IS STRONG IN ONE WAY AND WEAK IN ANOTHER

Stone, as you know, will support a very heavy load if that load is placed directly on it, but as you know, it breaks easily if the weight is placed upon a part that is not supported. A stone beam is not very strong, but a stone pillar will bear an immense load. We say that stone, and concrete, too, are strong under compression, but weak under tension. But we can make concrete stronger than stone. By placing steel bars in the concrete, the beam is made much stronger. Sometimes a web of steel is buried in the concrete.

This combination of concrete and steel is called reinforced concrete, and is very strong. Concrete stands fire very well, and floors of concrete with steel rods through them are used to help make buildings fireproof. Such a floor is stronger than if made of real stone.

Perhaps some of you have ridden on the underground railways in New York. For most of their length a wide and deep ditch was dug. A skeleton of steel beams and rods was made for roof and sides, forms were placed around it, and the concrete was poured in. The result is a water-tight tube, which supports the traffic above without difficulty.

NEW USES FOR CONCRETE ARE CONSTANTLY BEING DISCOVERED

New uses are constantly being found for cement and concrete. For several years concrete had been used for barges around harbors, but in 1918, real concrete ships were launched. Steel rods were bent into the proper shape and concrete was poured into forms around them. If these ships prove themselves able to stand the strain of rough weather, a great change in the building of ships will follow. Ships can be built of concrete more quickly and more cheaply than of steel. Think of ships of stone on the world's highway!

Besides the pictures belonging to this story showing the use of concrete, you may see a flour mill and storage bins built of this material on page 5715, and a grain elevator on page 5614. Many of the bridges you see are of concrete, and the great dams and wharves in many places. The Catskill Aqueduct, of which we tell on page 5193, is largely concrete.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 4265.

A CONCRETE SHIP IN THE WATER

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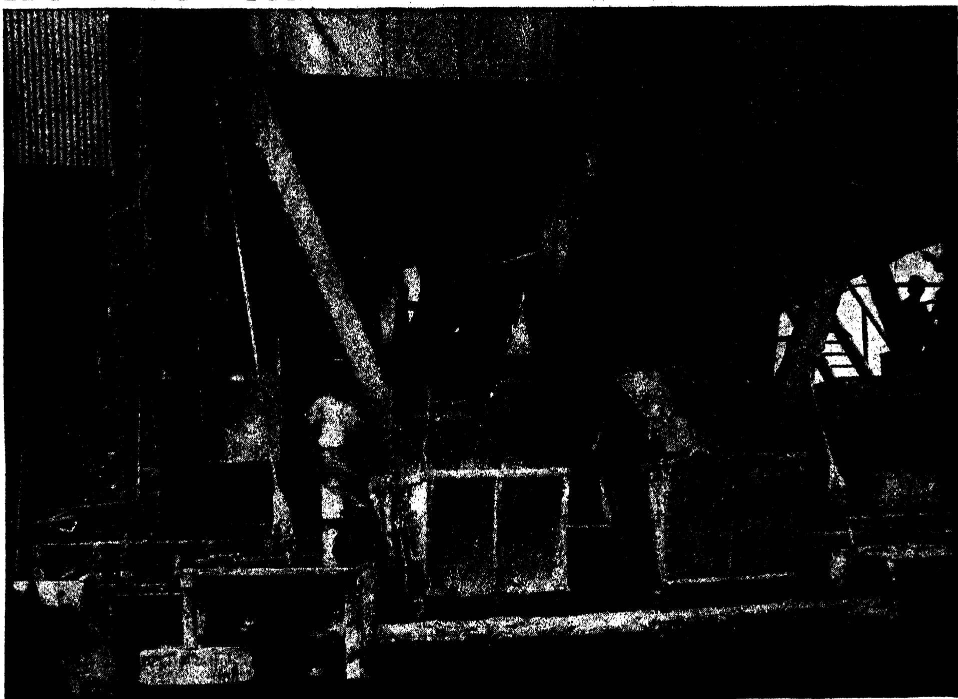
Here is the deck of the concrete ship, Faith, just before it was completed. As you see, the deck and the coamings around the hatches, as the square openings through the deck are called, are of concrete. The boat is built entirely of concrete, re-enforced with steel, and was made in forms, a little at a time.

On her trial trip across San Francisco Bay, the Faith surpassed the expectation of her builders, both in speed, and smoothness of motion, easily making ten knots. The boat is 320 feet long, and will carry 5,000 tons of freight. As boats can be made of concrete in much less time than they can be built of steel or wood, we are likely to hear much more of them in the future. Many of them have already been built.

HOW CONCRETE IS PREPARED AND USED



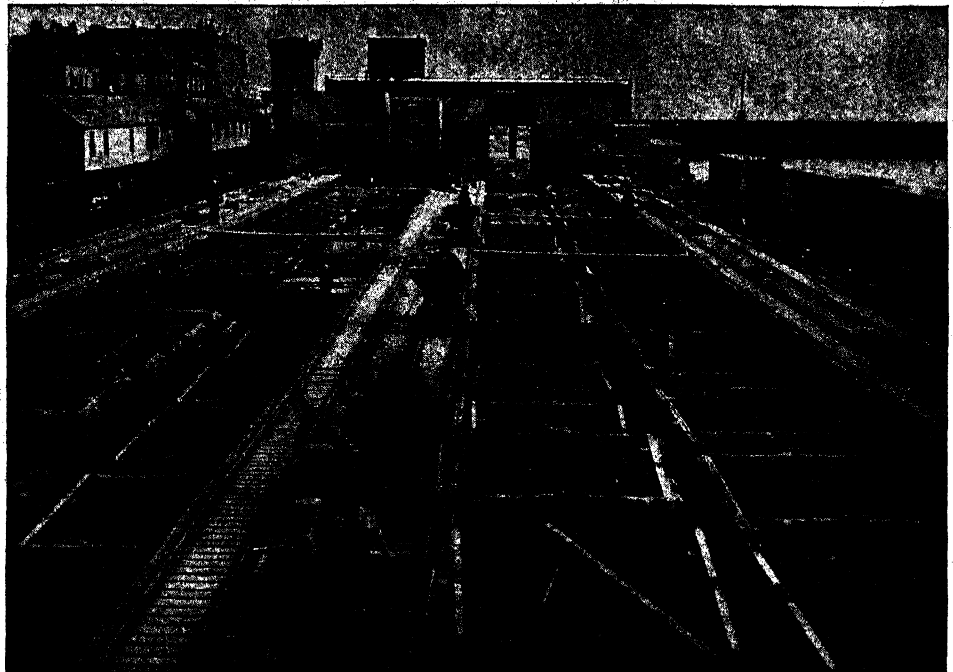
Millions of yards of concrete were used in the construction of the Panama Canal. Here are two of the huge mixers into which cement, sand and broken stone and water were poured and churned together. They were then tilted forward and the moist mass was deposited in the huge square buckets which were swung off by a crane. Thousands of pounds were mixed at a time, and the mixers were constantly refilled.

This picture will give you an idea of how a great concrete bridge is made. The false arch of wood is left in place until the concrete has hardened. Above you see the wooden forms with steel rods sticking from them. The concrete is carried to them over the wire ropes, which make a sort of railway in the air. The wooden sides hold the concrete in place until it will support itself.

A FINE EXAMPLE OF CONCRETE CONSTRUCTION

On the Lackawanna Railroad are some fine examples of concrete construction. The Tunkhannock Viaduct is shown in the story of Bridges. This is the Martin's Creek Viaduct, which is nearly a third of a mile long, and 150 feet above the bed of the creek. Some of the spans are 150 feet. In making it, 77,500 cubic yards of concrete, and 1,600,000 pounds of steel were used. The old line of the railway is on the right. Much money has been spent by the railroads to make their tracks more nearly level.

MAKING A GREAT MODERN HARBOR



Dover, in England, is not only an important port for traffic to and from the Continent, but it is now a great naval station, and the harbor which was commenced in 1897, when finished, enclosed an area of over 600 acres. The total cost amounted to about twenty million dollars. Here we see part of the harbor works.

This picture shows us the yard at Dover where the huge concrete blocks for the harbor breakwaters were made. The blocks were cast in great wooden molds, and each was dated and numbered. The largest blocks weigh 42 tons each. The wooden piles, or beams, used in making the harbor, measured 100 feet each, and weighed 10 tons. The remains of an old Roman pharos, or lighthouse, were discovered at Dover.

A PICTURE BY EDWIN A. ABBEY FROM SHAKESPEARE'S PLAY KING LEAR

MODERN AMERICAN PAINTERS AND THEIR ART

CONTINUED FROM 4222

YOU remember that in an earlier story we mentioned the name of George Inness as among the first of the American painters who saw the advantage of going abroad to study. He spent some time in Rome and in Paris, but, nevertheless, he was to a great extent self-taught. He was one of those men who study deeply and analyze for themselves all their teachers give them, but who never imitate the work of others.

He was born in 1825 at Newburg, N. Y., where as a boy he was apprenticed to an engraver. He was not strong and the close work proved too confining. He went to New York and studied for a time with a French artist. In 1850 he made his first trip abroad. His passion for nature, for beauties of skies and fields and trees, for masses of foliage, strengthened with his skill for portraying them. His early work is sometimes considered too finished in detail, showing the influence of his early training in engraving. He excels in conveying moods of nature, not only the beauty of a given scene but the way it makes us feel. He died in 1894, leaving a great and permanent contribution to American art. His son and pupil, George Inness, Jr., also became a landscape painter of note.

In thinking of American landscape painters, we always group together George Inness, of whom we have just spoken, and two younger men, Alexander Wyant and Homer D. Martin. As you may see by comparing their pictures, their work was not at all alike, but they worked at the same period and these three great men are looked upon as "the fathers of modern American landscape painting."

Alexander Wyant, who painted nature with a rare gift of poetic sentiment, was born in Defiance, Ohio, in 1836. He very early showed talent for drawing. When he was about twenty he visited Cincinnati and there for the first time had an opportunity to see fine pictures. He was especially charmed by one of George Inness's landscapes, sought out Mr. Inness in New York, and acting upon his advice, resolved to become an artist. He went abroad and studied under Gude, a graduate of the Dusseldorf school. Soon after his return, needing money, he entered the employ of the Government on a trip to explore the West. His health gave way under hardships and his companions put him aboard an eastbound train. Although it passed through his home town brave young Wyant determined not to give way to any weakness and continued on to New York to resume his art work. He was never entirely well again, and had to work with his left hand. Feel-

ing that his life might be short, he worked all the harder. Much of his work was painted in the Adirondacks, much in the Catskills.

Homer Martin was born in the same year as Wyant, 1836, at Albany, N. Y. His great talent was self-developed, for all the instruction he ever received was a few lessons from William Hart.

Martin had a defect of vision which caused much of the detail of nature to escape him. He saw things in mass and therefore that is the way he painted them, a method which many followed. He visited Holland, England, and France and formed many delightful friendships with fellow artists. Westchester Hills is by many considered his finest picture.

Winslow Homer was one of our greatest painters of ocean. Young and old enjoy his stirring pictures of fisherfolks and their lives, which he painted mostly along the Maine Coast. He was largely self-taught and always insisted upon painting things as he actually saw them, unmindful of conventional methods. He studied lithographing at first. During the Civil War he joined the Army of the Potomac, and the spirited drawings sent back to Harper Brothers soon won him fame. His finer work was not accomplished, however, until he became fascinated by the brave, simple people who live along old ocean and brave its perils for their daily bread. The Life Line, Eight Bells, Undertow are among his best known pictures.

AMERICAN PAINTERS WHO LIVE ABROAD

We now come to a group of painters who not only went abroad to study, but elected to spend most of their lives in Europe.

The first of these, James McNeill Whistler, who was born in 1834, is claimed both by England and America. He was truly an American, however. His father was in the army and he, himself, intended to enter the same profession. But at West Point he neglected his other work for drawing, and finally failed in his examinations. He then tried the Coast Survey, but his fingers simply would make pictures when they ought to be drawing maps, and after two or three years, he turned seriously to painting and went to study in Paris.

He first became known for his etchings, but his fame as a painter soon became world-wide. His training was world-wide too. Some of his portraits remind us of the work of Velasquez, the great Spanish artist, whom he much admired. In the early part of his career, when the Western world had just begun to discover the charm and beauty of Japanese art, he studied the Japanese prints and pictures, which he saw in Paris. They had a powerful influence upon him, and much of his early work brings us suggestions of the work of the best Japanese artists.

He was, however, no mere imitator. He gained a profound knowledge of the work of the masters, old and new, of both the Eastern and the Western worlds, and out of all this knowledge he created a method so original and individual that even if we know only a little about painting, we can usually recognize his pictures without hesitation. They are at the same time strong and delicate, and some of his portraits especially are very wonderful. The portraits of The White Girl, His Mother, and Carlyle, are well-known examples of those most characteristic of his brilliant original method.

Whistler saw beauty in everything, and in his painting, etching and writing, tried all his life to teach others to see it too. He used few bright colors, and his pictures may not at first appeal to us, but if we take time to study them, we shall end by loving them.

Elihu Vedder must be mentioned for his poetic and individual art. La Farge excelled him in richness of color, but perhaps no one excels him in skill in drawing, or in a strange fantastic imaginative charm. He has employed his talent in various ways—in illustrating books, in mural paintings, in mosaic, and in other pictures. Vedder had the advantage of studying both in Paris and in Italy, where he makes his home.

When you go to see the Boston Public Library, do not forget that one of the rooms is decorated with illustrations of the old story of the Holy Grail from our much loved Morte d'Arthur. The work was done by Edwin A. Abbey, another American painter whose fame, even during his lifetime, became world-wide.

Edwin A. Abbey began his artistic career as a draughtsman, but in a short time turned to illustrating, and was well-known as an illustrator by readers of Harper's Magazine for a long time before

AMERICAN SCENES BY AMERICAN PAINTERS

Here we see an example of the work of F. E. Church, entitled The Heart of the Andes. This artist painted subjects from the far North to South America, seeking always the impressive and magnificent. F. E. Church belonged to the Hudson River School, of which we have told you, and was one of the best painters of his day. You may read more about him in the first part of this story.

This picture, entitled Peace and Plenty, is a good example of the work of George Inness, though his later works were not done with so great detail as this shows. In coloring it is very beautiful and the evening sunlight, falling across the reaches of the river and the field of grain, lights up the whole picture. Inness, Wyant and Martin are grouped together as the fathers of modern American landscape painting.

he began to paint. He received his foreign training in England instead of in France, and for many years of his life, he made his home in an old manor house in Oxfordshire.

He is best known for his historical paintings, such as his scenes from Shakespeare, and to make them real, he studied carefully old books, and drawings, and illuminated manuscripts so that he might have a good knowledge of the dress and customs and manners of the people whom he painted. All his pictures gleam with beautiful coloring, especially the famous "Abbey red," and the figures with which they are peopled seem to be alive. They seem to speak to us from past days and tell us that the men and women whose stories he told with his brush once lived and moved and loved and suffered. He was so much esteemed in England that when Edward VII was crowned, Abbey was chosen to paint a picture of the coronation.

One of his friends was Frank D. Millet, who studied in Antwerp, and is best known for his mural decorations and what are called genre pictures, that is, for example, pictures of a room with a few figures in it as if living or working there. Although he made his home in England, the greater part of his mural painting was done in this country. His pictures are beautifully finished, his drawing is good, and all his work lifelike and real. He painted some portraits, but not many. He was drowned when the Titanic struck an iceberg and went down.

THE GREATEST AMERICAN PORTRAIT PAINTER WHO HAS YET LIVED

We now come to the greatest of our portrait painters—John Singer Sargent. He was born in Florence, Italy, in 1856, and the talent of the art-loving boy was developed by his early life in that wonderful city, where he had every opportunity of studying the work of the great Italian masters. He had the advantage, too, of studying in Paris under Carolus Duran, who was himself one of the foremost artists of his day. Sargent is a wonderful master of technical difficulties. It is true, that some critics say that he is so much in love with the technical side of his art, that he has not enough to spare for the spiritual side. They say that he makes a wonderful likeness of the man, or woman, whom he is painting, in the mood of the moment, but that he does not catch enough of the spirit within. To him, a weary old man is a weary old man, and little more. They say that he tells exquisitely the ageing of the man in the outlines of the body, in blue-veined hand and in wrinkled cheek, but that the portrait does not tell enough of the struggles that have gone on in the man's mind, throughout his life, and of the battles lost or victory won either for good or ill. The great masters could tell this story with brush and paint, and it is chiefly for this power that we call them great. Whether or not Sargent has this power in large measure, the fact remains that he is the greatest portrait painter of our time, and the greatest American portrait painter that has yet lived.

Sargent paints pictures of children with a tender sympathy that shows that he loves them. Although he lives most of his life abroad, he has spent some of his time in this country, and some of his finest pictures are portraits of Americans. His famous mural decorations in the Boston Public Library are among the first things that we look for in that beautifully decorated building. These great paintings occupied much of his time for a number of years, and it is said that he looked upon their execution as a labor of love.

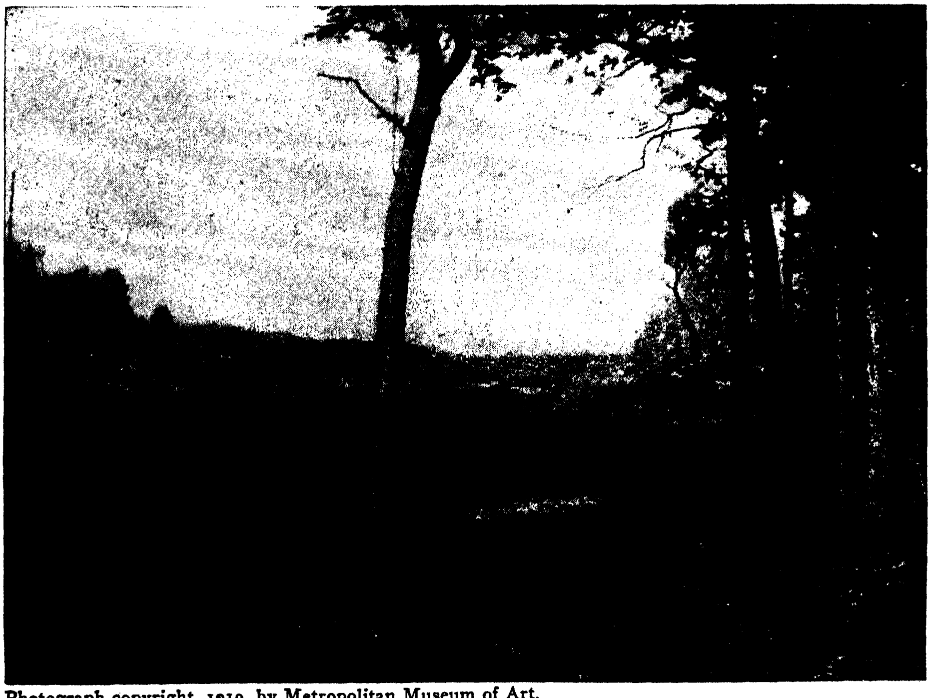
SOME AMERICAN PAINTERS WHO STUDIED AT HOME

Although, as we have seen, from the middle of last century our young artists flocked to Europe to study, some American painters did not come under the influence of European teaching in their student days. One of these was Ralph A. Blakelock, who at the close of last century was one of the best American landscape painters, and some of whose pictures have been called "symphonies of color." He was an invalid for many years, and unable to paint, and his pictures were neglected and forgotten. After a time, however, some of his landscapes were sold for a good deal of money. People began to talk about the beauty of his work and he had the happiness of knowing that he was again remembered.

Albert P. Ryder, many of whose pictures attempt to illustrate great literary ideas, is another painter who studied at home. A third independent painter, but one who belonged to an earlier date, was George Fuller, who was born on a Massachusetts farm in 1822. His best known

LANDSCAPES, FRENCH AND AMERICAN

Though usually called a View on the Seine, this picture by Homer Martin was really painted in Normandy. This is an excellent example of his work and is of surpassing beauty. Its colors are exquisitely clear and soft, and the picture gives one a feeling of peaceful calm. The painter called the picture the Harp of the Wind. The painting of the limpid water, and the soft clouds in the sky is especially good.



Photograph copyright, 1910, by Metropolitan Museum of Art.

Some consider this one of the best examples of A. H. Wyant's work. It is entitled Forenoon in the Adirondacks. You can see the sunlight falling on the hills in the background, while the trees in front and the little pool lie in shadows. The picture is now owned by the Metropolitan Museum of Art, New York.

picture is Nydia, which is in the Metropolitan Museum of Art. He showed a great deal of feeling in both his landscape and figure painting, and it is this and the coloring in his pictures that attract us to them.

The test of knowledge is to be able to apply it to our own problems, and, from what we have learned, work out new ways of doing things. If we can do this, we can be sure that we have made knowledge our own. This is what American painters have done. For years they have been taking the best from all the foreign influences, and bringing them to bear in the home field.

SOME NOTED PORTRAIT PAINTERS OF RECENT TIMES

As we have seen, some of them elected to live abroad, but the number of those who have come home is legion. Among them J. W. Alexander, William M. Chase and J. Carroll Beckwith are three men whose names as portrait painters were household words for many years. None of the three was great, but they all did genuinely good work, which will probably be remembered and prized much as we remember and prize the work of the lesser English portrait painters of the eighteenth century. William M. Chase was noted also as a painter of lifeless objects, or still life, as artists say. His pictures of fish are especially good.

Thomas Eakins painted stronger portraits than any of these three men, but his work often lacks the grace which theirs possesses. Wyatt Eaton was a well-known portrait painter who lived at the same time as George Inness.

When we think of all the good pictures by American artists that we have seen, we realize how difficult it is to decide among them, while at the same time if we attempted to mention all the men and women who have done excellent work, this story would simply turn into a list of names.

Among the best known is George de Forest Brush, a pupil of the great French artist Gérôme. The strange picturesque life of the American Indians appealed to his imagination and in his early life he devoted his best talent to painting them. In Silence Broken, and Mourning Her Braves he shows much sympathy with this taciturn people. Of late years, he has taken to painting family groups, usually of a mother with her children, which give us something of the same feeling as the Madonna pictures of earlier days. Another artist who paints madonna-like women is Abbott H. Thayer, who thus idealizes the women of his native country.

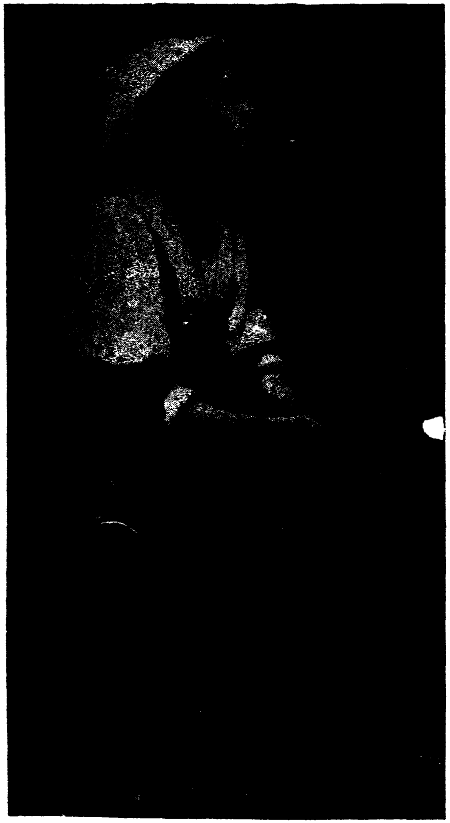
There are many other portrait painters and figure painters of note among us. Thomas W. Dewing paints exquisite studies of women. Gari Melcher's portraits tell the story of freshness and simplicity in the young people whom he delights to paint. Robert Henri is another portrait painter of note, who gives us rich, harmonious pictures, and also paints richly colored pictures of trees, with light flashing between the trunks, and lighting up the dim recesses of the wood. Among women portrait painters the two who stand out most prominently are Mary Cassatt, who spends most of her time in France, and Cecilia Beaux. Mary Cassatt loves best to paint little groups of mothers and children, in soft, quiet colors. Like all really fine artists, her drawing is especially good, and makes the little ones in her pictures look like babies and children that are really alive. Cecilia Beaux paints brilliant portraits, of which other artists speak approvingly as good work.

MODERN LANDSCAPE PAINTERS WHO TRY TO PAINT LIGHT

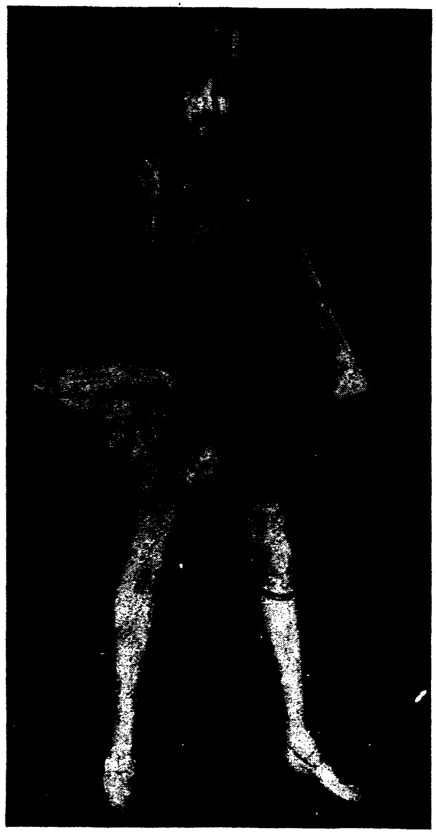
When we look at the pictures painted by our modern landscape painters, we notice a great difference between them and the early American landscape painters. This is because they do not, like Doughty and Durand, try to put into the picture everything that the eye can see in the city street or the countryside. Instead they paint clearly the things that stand out with clearness, and for the rest give us what we call "impressions." Besides this, following the example first set by the English painter J. M. W. Turner, they pay a great deal of attention to the effect of sunlight, and the play of light and shade in the open air.

Childe Hassam, who has done much to draw attention to the picturesque side of New York, excels in this. He charms us with the reflected lights in the streets on a rainy day, or dazzles us with the brilliant colors that he sees in the sunshine of a summer afternoon. J. Alden Weir, who paints portraits, landscapes and interiors, also revels in light, but he gives us quieter colors to enjoy. D. W. Tryon teaches us to look for delicate

SPECIMENS OF THE WORK OF HUNT, WHISTLER, AND CHASE



The Figure of a Girl was painted by William Morris Hunt, whose story is told elsewhere. It is interesting to compare his work with the other pictures on this page.



In this portrait of Henry Irving as Philip II of Spain, by James McN. Whistler, the painter has well shown how the actor lost himself in the character that he portrayed.

This picture of Carmencita, a Spanish dancer, is a good example of the work of William M. Chase. You can see that the figure is full of life and motion. A fine picture of the artist, by Sargent, is on page 4255.

PLACID FIELDS AND STORMY SEAS

In this landscape D. W. Tryon has succeeded in giving us the impression of the constant flow of water in the brook. The whole picture, with its leafless trees against a cloudy sky, breathes the spirit of winter. Notice how the break in the trees in the background gives the feeling of mystery, as if some unseen road led off into limitless distance. This artist is fond of painting just such quiet scenes as this.

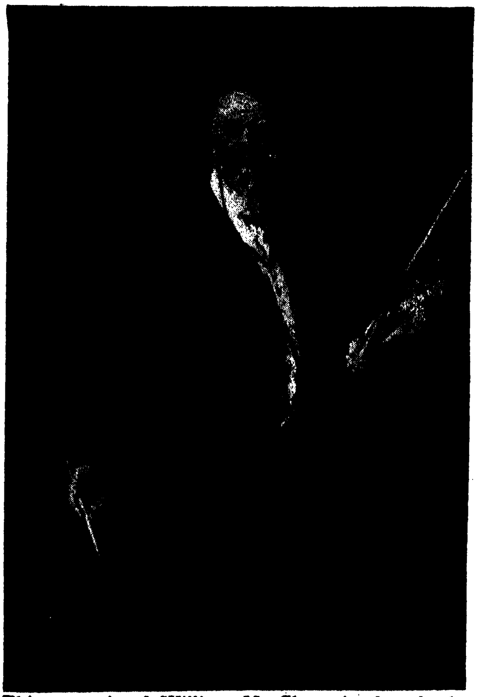
In this picture by Winslow Homer, we have the strong surge of stormy waves breaking on the rocks of Maine. The artist has well contrasted the passive strength of the rugged rocks with the violence of the waves that are dashing themselves into spray and foam against them. The picture gives a good idea of the turbulence of the sea on a rocky shore.

All pictures in this story except Childe Hassam's picture of Fifth Avenue are reproduced by courtesy of the Metropolitan Museum of Art.

FIGURES BY FOUR AMERICAN PAINTERS

In this picture by Cecilia Beaux, the light on the intent face and girlish white-clad figure is accented by the dark woodwork. The picture is a good example of the brilliant work of this artist.

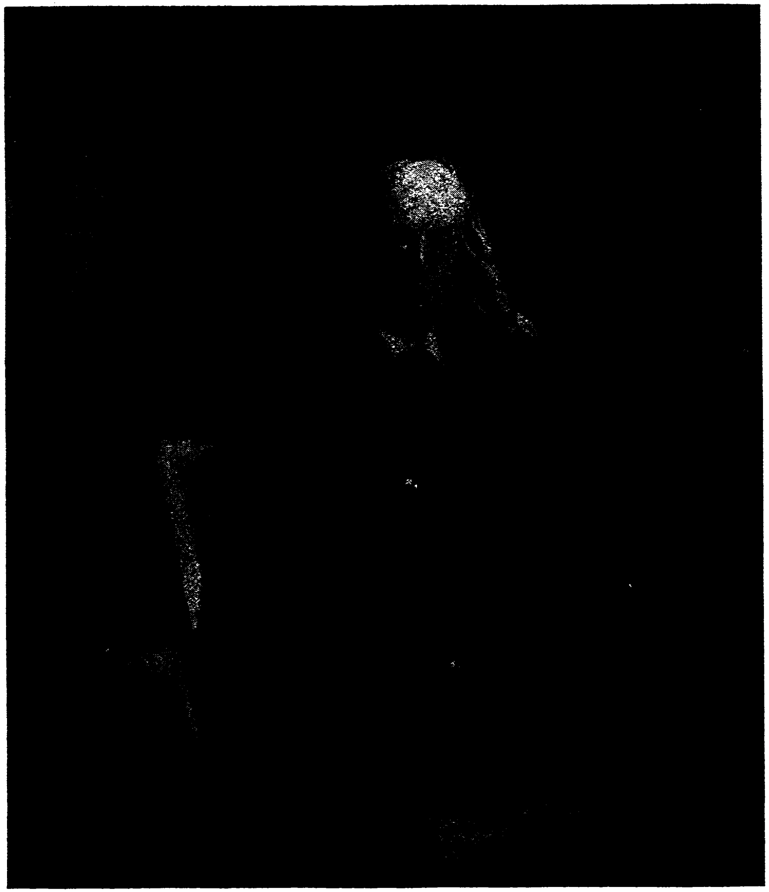
Mary Cassatt's Mother and Child shows well the tender care of the mother, who is drying her little one after her bath. The artist has given us successfully the happy look of a child fresh from sleep.



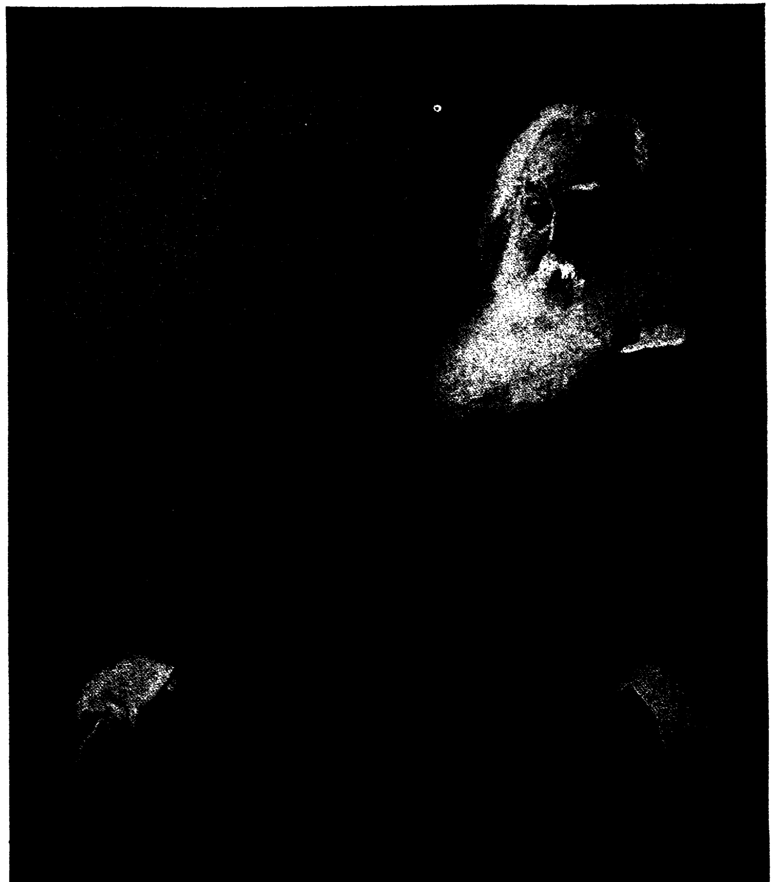
This portrait of William M. Chase is thought by many to be one of the finest examples of Sargent's work. The pose of the figure is remarkably fine, and the whole picture shows the great artist at his best.

This figure of a young woman, by Thayer, might be a modern Diana. Although she is seated, her attitude and the way in which her weight is thrown on her hands gives her freedom of movement.

TWO FAMOUS PORTRAITS BY TWO FAMOUS MEN

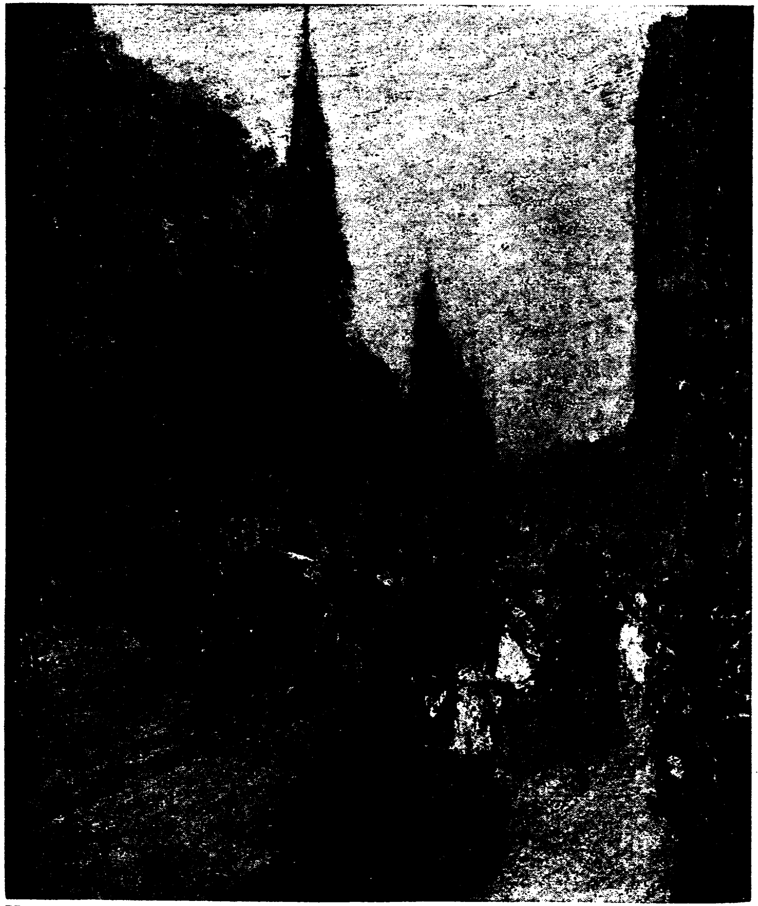


This portrait of Henry Marquand, by John S. Sargent, is a delightful picture of a man in the evening of his life. As in all his work, Sargent has made the surroundings of his sitter very simple so that the attention is not distracted from the portrait.

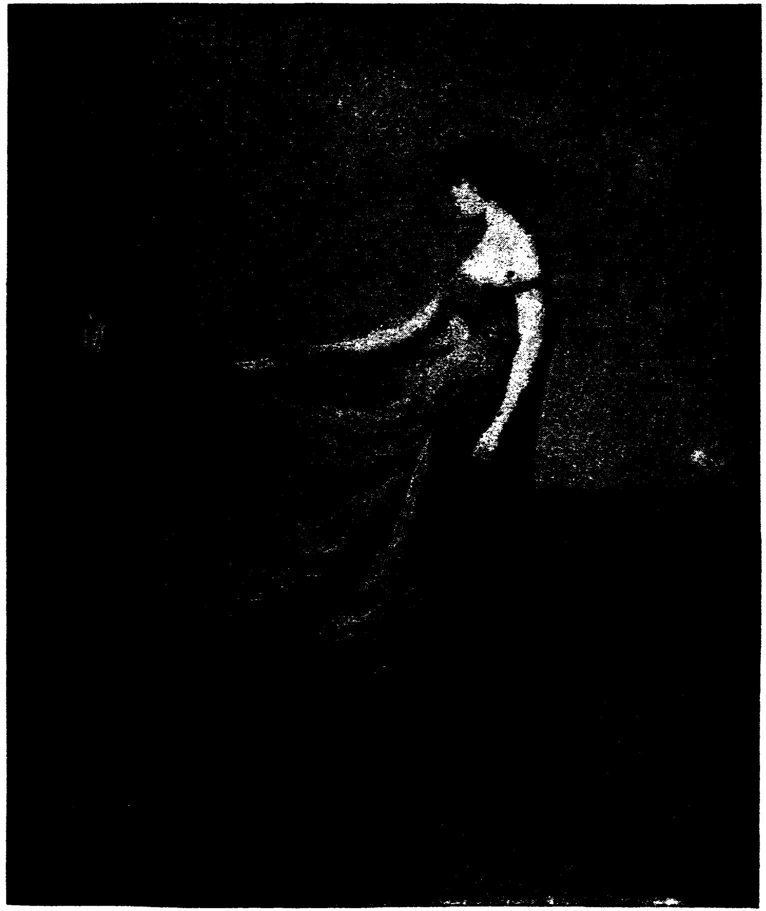


John W. Alexander's work is always interesting, and his portrait of Walt Whitman, the "Good Gray Poet," is fascinating. There is something about the lion-like head which compels your attention. Some think this is Alexander's best work.

INTERESTING PICTURES BY TWO MODERN PAINTERS

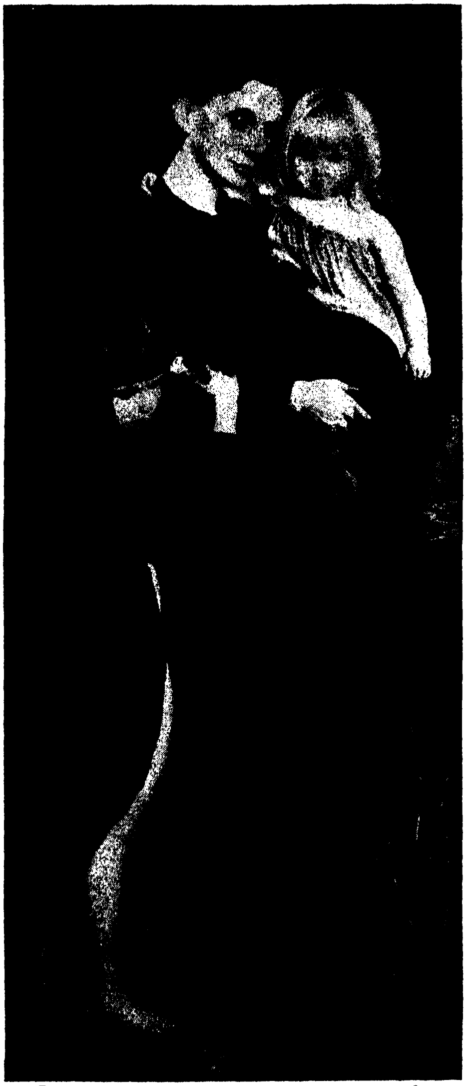


Here we have an "impressionist" picture by Childe Hassam. The artist has made nothing definite, but has given us his impressions of Fifth Avenue on a sunny day.



This picture by Thomas W. Dewing shows how much can be expressed by simple lines. The Letter on the low desk to the left gives the picture its name.

beauties in our landscapes, with beautiful feathery trees, or dimly lighted moorland veiled in a pearly mist. His pictures have a depth of spirituality and mystery that gives us a feeling of peace as we watch them. John W. Twachtmann painted landscapes and pictures of the sea which



In the Garden, by George de Forest Brush.

have a haunting beauty that no one can forget. Among women painters, Charlotte B. Coman gives us pictures of a country made to live in, with trees and houses bathed in warm bright sunlight.

THE PLACE OF MURAL DECORATIONS IN AMERICAN ART

Mural decorations now play a very important place in American art. Like the Italian city republics, of which we have read in another place, we have begun to beautify the walls of our public buildings with paintings, and, as in the old days, our best artists are called upon to do this work.

We have spoken already of La Farge's mural decorations and the great work done in the Boston Public Library by Sargent and Abbey. J. W. Alexander was also noted for his mural painting, and so is J. Alden Weir. Then there is E. H. Blashfield, who has painted the dome of the Library of Congress and many other fine wall pictures. C. Y. Turner, Will H. Low, Kenyon Cox, Frederick Dielman, and E. E. Simmons, have all given of their best to beautify churches, colleges, public buildings, and the walls and ceilings of private houses.

Many readers of THE BOOK OF KNOWLEDGE will have an opportunity of seeing the Library of Congress in Washington. When you do, do not think of it as one big, handsome building to be seen, but study its mural decorations carefully and store away their beauty in your minds. Every one of them was painted by an artist who strove to do his country honor.

Horatio Walker also paints mural decorations as well as landscapes, but his name belongs to the story of Well-Known Canadians, which you will find elsewhere.

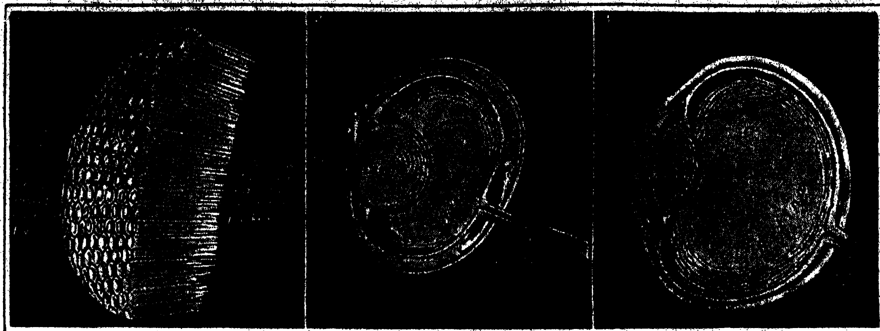
There are other men and women of whom we ought to speak. Leonard Ochtman, Elliott Daingerfield, Charles W. Hawthorne, Paul Dougherty, Frederick Ballard Williams, Lydia F. Emmett, and dozens of others deserve more than a mere mention of their names.

The work of these painters, and of others whom we have not space to name, is said, by men who know, to be at least as good if not better than the work of painters in the Old World.

Some day, perhaps, we shall follow the example of France and establish a museum as well as a library in each of our small towns. Then we shall be able to study and enjoy the pictures that our artists are painting for us, and we shall learn to honor them for the beauty that they bring into our lives.

To-day we have artists of whom we are rightly proud, who seek to show us, through their art, the loveliness of the hidden soul of things.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 4359.c



The first picture shows the eye of a fly, the second of a fish, and the third of a man, and we can see, by comparing these, how much nearer the fish's eye is to a man's than is that of an insect.

THE STORY OF THE EYE

CONTINUED FROM 4098

THE sense which we are now going to study is vision, or seeing, and the organ of this great sense, as everyone knows, is the eye. In many ways, this is the most wonderful and important of the senses. It is so for the purposes of practical living. It is more necessary to see than to hear, or taste, or smell. A blind man is at a greater disadvantage than a deaf man. The progress and ascent of living creatures on the earth have very largely depended upon vision, and we have already learned that the vision part of the brain is largest in the highest forms of life. It is much larger in ourselves than in any other creature.

Vision is also of the highest importance for our ideas of the world in which we live, just as it is for our practical doings in that world. If we could not see we should know very much less of our own earth, and we should know the sun only by the radiant heat that he sends us; and all the other heavenly bodies would be unknown to us—from our own little moon to the millions of stars. It is upon our eyes, then, that our knowledge of the great world beyond our own earth depends, and on this claim alone our eyes are entitled to special respect. Unlike any of our other senses, they put us directly in touch with the infinite and the sublime. One of the greatest men who ever lived, Emmanuel Kant, said that there were two things which filled him with awe—the feeling of duty inside the minds of men and the starry heavens above us. Let us begin, then, by studying how, in the course of long ages, living creatures have been able to develop the eyes by which the starry heavens are seen.

This question of the history of the eye is deeply interesting. A short time ago we should have begun straight away with the history of the eye in the animal world. It would not have occurred to anyone that there was anything to say about eyes or seeing in the world of plants, but it has been discovered that something like seeing is not confined to the animal world. We find that certain especially sensitive spots are to be found on the leaves of plants. If we are really to understand our own eyes, therefore, we must begin at the beginning, with something much older and simpler than our eyes or any part of us.

The eyes of plants, if we may so call them, are very simple. The business of a green plant, and especially of the leaf of such a plant, is to receive and use the light that falls

upon it. It is therefore in the leaves of plants that we find their eyes. Simple experiments—which have now been made many times over, with many kinds of plants—show, to begin with, that somehow or other the leaf is sensitive to light.

For instance, if the direction of the light is altered, in a very short time the leaf turns itself, so as to get the light fair and square upon its surface; and some leaves will do this as often as the direction of the light is changed. We may, perhaps, get rather wrong ideas if we say that the leaf sees the light, yet that must be what happens; only it is a very simple kind of seeing. It is, perhaps, rather like the very first kind of seeing that is done by a new-born baby.

THE LITTLE EYES BY WHICH A LEAF CAN SEE

After it had been completely proved that somehow or other the leaves can see, the next thing, of course, was to find whether the leaf saw as a whole, or whether it had any special places where it saw—places which must be called eyes of a kind. When the surfaces of leaves were carefully examined, it was often found that there were places where there was developed a kind of simple eye. That is to say, certain of the cells forming the surface of the leaf were made of a special shape; it was found that the outside of these cells is curved, just as the front of our eyes is curved.

The consequence is that light falling upon these cells is focused, as we say, and thrown upon the floor of the cell, just as a curved piece of glass will focus the sun's rays and throw a bright spot on a piece of paper. If the leaf is at right angles to the light, then the bright spot made in this way will fall right on the middle of the floor of the cell.

WHAT HAPPENS WHEN A LEAF DOES NOT LOOK STRAIGHT AT THE LIGHT

This corresponds to what happens in our eyes when we are looking straight at a thing, and the picture of that thing falls, as we shall soon learn, upon exactly the right place at the back of our eyes——the place where we see best. But when the leaf is not facing the light—not looking straight at it, as we might say—the little bright circle that should fall upon the middle of the floor of the cells is thrown somewhere to one side of the floor, or may even be thrown not upon the floor of the cell at all but upon one of its walls; and the life of the cell knows the difference.

Of course, these discoveries have excited the greatest interest among those people who care for these things, and at first, as was quite right, many doubts were expressed, but these have all been cleared away. In the first place, it was necessary to prove that the curving of the surface of the cells really made them act like little lenses.

In two ways this can be proved: either the surface of the leaf can be, so to speak, shaved down, so that it becomes flat, or else a little water can be laid on the leaf and then covered with a thin sheet of glass, in such a way that the water fills up the hollows between the cells, and so makes the leaf flat, whereas before it was covered with hundreds of little bulging eyes.

When these experiments were made, it was found that the plant no longer responded to the light; the leaf no longer turned so as to face the light directly—in a word, it no longer knew where the light came from. Its sight had been spoiled, just as our sight would be spoiled if something of the kind were done to our eyes.

PHOTOGRAPHS THAT CAN BE TAKEN WITH THE EYES OF A LEAF

And then, still more lately, the power of these little eyes was proved in another way. If these cells with their curved fronts really act as lenses, then, with care and skill, it ought to be possible to make them take photographs—that is to say, it ought to be possible to use these little cells as the lenses of a hundred tiny little cameras. This has been done, and the most excellent photographs have been taken—photographs so good that the person photographed can quite easily be recognized when the photograph is magnified and thrown on a screen.

This subject is quite new, and we are only at the beginning of our knowledge of it. A beginning has been made, however, with a new chapter in our knowledge of plants and their wonderful lives. Here, it is sufficient just for us to know that plants, which live by the light of the sun, and upon whose life our own lives depend, have little eyes of their own, which they use for their lives, and therefore, in the long run, for ours. It is because all animal life depends upon plants that we should know these things. And now we can go on to

study the history of the eye in the animal world.

In the very lowest forms of animal life we find that there is response to light, for we find that some of the simplest kinds of animal will always travel from shadow into the light, and others will always travel from light into shadow. These are creatures whose bodies are so simple that we should not look for any special organ of vision.

HOW THE FIRST TRACE OF AN EYE IS FOUND IN THE SKIN

Probably the first trace we have of such an organ—that is to say, the first trace of an eye—is where we find that, in certain lowly animals, parts of the skin are very sensitive to light. We find in such cases that the color of the animal changes according to whether it is in light or in darkness or in shadow, and when its skin is examined under the microscope, we find that it contains a large number of cells packed with colored material.

This is usually called pigment, which is simply the Latin for paint—in fact, another form of the word paint. These pigment-cells are sensitive to light. When light shines on them, all the pigment is gathered tightly up into the body of the cell; but when the light is taken away, and they are in shadow, the pigment strays out in all directions from the centre of the cell, and so is scattered.

This explains why the color of the animal changes, and it also tells us why and how the animal is able to know what the state of the light is, and to act as it pleases accordingly. In the study of the history of the eye, great stress has always been laid upon these pigment-cells; but now that we have discovered such wonderful eyes in leaves, fitted with lenses so perfect that they will take photographs, the pigment-cell, which we look upon as the beginning of the animal eye, seems to be a very poor affair compared with a plant eye.

THE LITTLE CELLS IN THE SKIN UPON WHICH LIGHT ACTS

We do not know exactly how it is that light affects the pigment-cells, but we may be sure that the action is really a chemical one. Everyone who is interested at all in photography knows that light has a chemical action—as, for instance, on the salts spread on a photographic plate. Every housewife whose curtains fade, or who puts clothes out to be bleached, knows also that light has a chemical action. Its action on the pigment-cells is chemical also; and when we come to study what happens in our own eyes when the light strikes the curtain at the back of them, we shall find that what happens there is very like the action of light when it takes the color out of a curtain or a dress.

What happens next in the history of the eye is that the pigment-cells, which were at first scattered about the surface of the body, are now specially collected in certain places. These cells are not quite on the surface of the skin, but are underneath the outer skin, and the next stage is that, at the place where the pigment-cells are gathered together, the outer skin, or epidermis, becomes thickened, and bulges a little. Now, this is very important, because if we have a bulging, that is to say, a curved surface, through which the light must pass on its way to the pigment-cells, we have indeed a lens of the shape called *convex*, and, as we know in the case of the burning-glass or the lenses of leaves, the result is that the light is focused.

THE SIMPLEST KIND OF EYE, AND THE WONDERFUL EYE OF A FLY

Now, we have already learned enough to be sure that these pigment-cells, like every other part of the body, are connected by nerves with the brain. So now we have reached the stage where there is a lens to focus the light, sensitive cells to be chemically affected when the light falls upon them, and nerves that somehow convey a record of these changes to the brain, which therefore sees. Here, then, is a simple kind of eye, complete from the surface to the centre.

All the eyes of animals that have no backbone are to be looked upon as simply improved patterns of this kind. The eye in such creatures is always developed from the skin in the case of each individual, just as we have learned that, in the history of these animal forms, the eye has gradually become developed from the skin. We shall soon see that the eyes of backboned animals are of a much higher type; but we must not underrate all the eyes below backboned animals, because it is very certain that the eyes of some insects are exceedingly keen. It is generally agreed that the dragon-fly is the most wonderful insect of all in this

respect. Its eyes are extremely large and powerful. As in many other cases, the lens of the eye, instead of being just curved in one single simple bulge, so to speak, is like a large diamond that has had its face cut into a number of little flat surfaces. These little faces of the lens are usually called *facets*. The number of facets upon the lens of the eye of the dragon-fly has been counted to be as high as 17,000!

HOW THE DRAGON-FLY AMUSES ITSELF BY MAKING FUN OF MEN

Few things are more wonderful than the certainty and skill with which the dragon-fly will recognize, follow, and catch the smallest insect on the wing. Professor Forel, one of the many wise men who have made Switzerland famous, and one of the greatest students of this subject, wrote as follows: "By trying to catch them at the edge of a large pond, one can easily convince oneself that dragon-flies amuse themselves by making sport of the hunter; they will always allow one to approach just near enough to miss catching them.

"It can be seen to what degree they are able to measure the distance and reach of their enemy. It is an absolute fact that dragon-flies—unless it is cold or in the evening—always manage to fly at just that distance at which the student cannot touch them; and they see perfectly well whether one is armed with a net or has nothing but his hands. One might even say that they measure the length of the handle of the net, for the possession of a long handle is no advantage. They fly just out of reach of the instrument, whatever trouble one may give oneself by hiding it from them and suddenly lunging as they fly off."

We must not suppose that all insects have good eyes; there are all stages between the dragon-fly, at one extreme, and insects which are completely blind, as, for instance, the cave-dwelling insects and certain kinds of ants.

THE HOUSE-FLY THAT HAS LEARNED TO KEEP AWAY FROM THE GAS-FLAME

The rule for most insects is that they fly towards the light. Artificial lights, such as we use, do not occur in Nature, and an insect flying towards a lamp really supposes that it is flying towards the light of day. It is most unfortunate, from our point of view, that a good many domestic insects have learned in the course of many years to know what artificial light is. We cannot now enter into the very difficult question how it is that this change has been brought about in their natural habits; but, at any rate, it is the case that such an insect as the ordinary fly—as we know it now—does not destroy itself by flying against a flame, and so is able to live freely in our houses.

The habits of flies are extremely dirty; their feet are always laden with filth. They are thus great carriers of disease, and destroy many babies every year by poisoning their food. That is why it is very unfortunate that flies have learned how to behave to artificial light in what, for their ancestors, would have been an unnatural way.

Many years ago Lord Avebury showed that bees and wasps were able to distinguish colors; but wasps are very inferior to bees in this respect. Bees distinguish all colors, and very rarely make any mistake except between blue and green. The importance of this is very great, because it largely helps to explain how it is that bees are able to distinguish one flower from another.

INSECTS THAT CAN SEE WHAT OUR EYES CANNOT SEE

As a rule, the color of a flower is a kind of flag held out to say to a bee or other insect: "Come here; I have something that you will like." So the bee gets its honey and the flower is fertilized. Thus we owe the pleasure our eyes get from most of the beautiful flowers we know to the fact that the eyes of bees and other insects are able to see them and to distinguish them. If there were no insects there would be no beautiful flowers; there would be nothing for the plant to hang out its flag for.

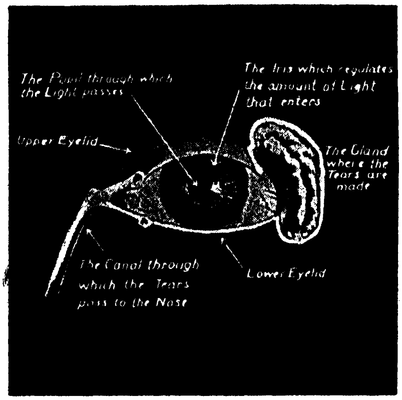
It was also proved by Lord Avebury, years ago, that ants, for instance, can see kinds of light to which our eyes are blind—that is to say, the light which lies beyond the violet, and which is known as *ultra-violet* light.

Here we may notice, what has recently been shown, that people's eyes vary in this respect. Just as old people do not hear high-pitched sounds, which younger people can hear, so we find that there are a good many young people who, something like ants, can see a short way, so to speak, into the ultra-violet, where, to the rest of us, it is quite dark. Finally, Lord Avebury has shown that ants are

able to recognize each other after more than a year of separation. Let us beware of judging the value and power of things by their size, and let us learn from this brief account of one of the senses of insects that we still have reason to go to the ant to " consider her ways and be wise."

Now we must pass to the eyes of backboned animals. The lowest kinds of backboned animals are the fishes, and we have all seen the eyes of fishes. Wonderful and skilful as the eyes of insects may be, the eyes of backboned animals are of a much finer and more wonderful type. In the first place, this seems to depend upon a change in the making of the eye. We have seen that the eyes of all the animals that have not backbones are entirely formed from the skin; but the higher type of eye found in backboned animals has its most important parts developed from the brain and not from the skin at all.

True, the front part of such eyes as our own is formed from the skin, but that is only true of the parts through which the light travels on its way to the all-important curtain which makes the back of the eye. That curtain is really a part of the brain which has been pushed out, as it were, from the brain upon a kind of stalk or stem.



The left eye, showing the glands where the tears are made and the ducts through which they are carried to the nose after washing the eyeball. In weeping, the tears cannot all pass through the ducts, and so overflow.

The real reason why the curtain, or rétina, of the eye of backboned animals has its great powers—vastly superior to those of any lower type of eye—is that this retina is, indeed, a part of the brain itself. Vision is so important that the brain, so to speak, could not leave the business of receiving the light-rays to anything developed from the skin, but decided to send out a portion of itself, so that the work should be done as well as possible.

In main principles, the eye of backboned animals is much the same, no matter which particular animal we take. The eye of the fish is certainly very much inferior to that of a bird or a mammal, as we should expect, if we consider that the fish has to see only in water, where it would be impossible for any kind of eye to see more than very short distances; but even the eye of the fish is, in all the main points, the same as our own, though much simpler.

We need not discuss specially the eyes of birds, though everyone knows that they have some powers superior to those of the eyes of any other creature. These powers are in the direction of keenness, so that we say of anyone who is very sharp to see things that he has the eyes of a hawk. This keenness is at its best in the case of the hawk and other birds of prey, but other birds also have very keen eyes. They could not catch flying insects if they had not. In praising the eye and the keenness of vision in birds, and in studying their eyes, we must not make the mistake, which is commonly made by almost everyone who has studied this subject and written upon it, of supposing that mere keenness of vision is everything.

It is easy to see what a mistake that is, if we consider the case of a sailor, for instance, who has very keen eyes indeed, and can see far into a fog, but who would perhaps never cast a second glance upon the most noble picture that was ever painted, or upon the most lovely landscape. On the other hand, a great artist may be old and very nearly blind, and though his vision is very dim, yet he can see in a sunset or in a picture things which mere keenness of vision, whether in a man or a hawk, could never see at all. This is worth remembering, for it is just as true of all the other senses as it is of vision.

Keenness of sense is very good in its way, and well worth having, but it is one thing to have sharp eyes or sharp ears, and another to have eyes or ears, perhaps not at all sharp, which can see and appreciate the really beautiful and lovely. If we remember this, we shall be very far from agreeing with those

who say that the eyes of birds of prey or of the dragon-fly or of the tiger, or of certain of the lower races of men, are better and finer eyes than our own; they are nothing of the kind.

We are entitled to say they are not because we know that keenness is not the highest quality of a sense, and the best proof of the rightness of our view is to be found in the fact that, when we test the matter by the brain, we find that the vision area is largest and most highly developed, not in the insect or the bird, or in the men with the keenest eyes, but in the brains of the highest type of men, who have learned to see and love what is beautiful and poetic.

THE EYELID THAT WASHES THE EYEBALL AND KEEPS IT MOIST

And now we are prepared to look at our own eyes and see how they are made. It is right just to mention the eyelids, because they exist for the sake of the eyes, and the eye cannot get on without them. We are very wrong if we suppose that the eyelids merely exist in order to cut off the light when we do not wish to see. They have that purpose, but if we had to do without them, and replace them by an artificial shade, we should soon find that that is not the whole of their use, but that they have another use that is of the greatest service to the eyes.

Every time that we wink—which we do every few seconds without thinking about it—the upper eyelid washes the front of the eyeball by means of a tear which has come from the tear-gland, and has been spread over the inside of the upper eyelid.

The tear-gland lies above the eyeball, a little to its outer side. The tear, after washing and moistening the front of the eyeball, passes through a tiny hole at the inner end of the lower eyelid into the nose, as may be seen in the picture of the eye on page 4263.

WHY WE CRY WHEN WE ARE IN SORROW OR DISTRESS

The reason why we cry when we are distressed seems at first to be that the part of the brain connected with the tear-glands lies very close to the part of the brain which is disturbed when we are made unhappy. It has been pointed out that if the arrangement of the brain were slightly different from what it really is, instead of producing an extra quantity of tears when we were miserable or unhappy, we might produce an extra quantity of saliva.

This very unpoetic suggestion was made by a poet. It has been credited by several students of the subject. The present writer believes, however, that the truth is very much more poetical than that poet suggested. The real reason, we may believe, why we show signs of distress in our eyes rather than anywhere else is that we human beings live by one another's help and sympathy and love. We are meant to see when others are unhappy, so that we may know, beyond any doubt, when they are needing our sympathy and help.

If a child's mouth merely watered when it was unhappy, we should not know, and therefore would not help it; but when we see its eyes water our sympathy is aroused, and we help it. We cry, not because the brain happens to be so made, but the brain has been so made because crying is the most useful and convenient way in which our distress can be shown to others.

HOW THE FACE AND THE EYE EXPRESS OUR FEELINGS

As the higher parts of the brain develop we learn self-control, and cry very much less readily than when we are quite young; but it is still true that our feelings find expression that can be seen by other people, for the face shows our feelings, and when we make a general study of the way in which our feelings are expressed by the various parts of the face, we shall see that crying fits in with these other ways of expression as the watering of the mouth would not, so that it is more than a mere chance that sorrow and sadness find expression in the shedding of tears rather than in the production of saliva or in some other way.

The eyelids are provided with hairs which help to protect the eyes from dust. Besides the protection afforded by the eyelashes, we must reckon with the eyebrows, as they prevent the sweat of the forehead from running into the eye. Lastly, we have to notice the well-contrived bony structure of the skull around the eye, which furnishes a very wonderful protection.

THE NEXT PART OF THIS BEGINS ON PAGE 4329.

Drying Cleaned Sponges in Florida.

THE LIFE OF THE SPONGE

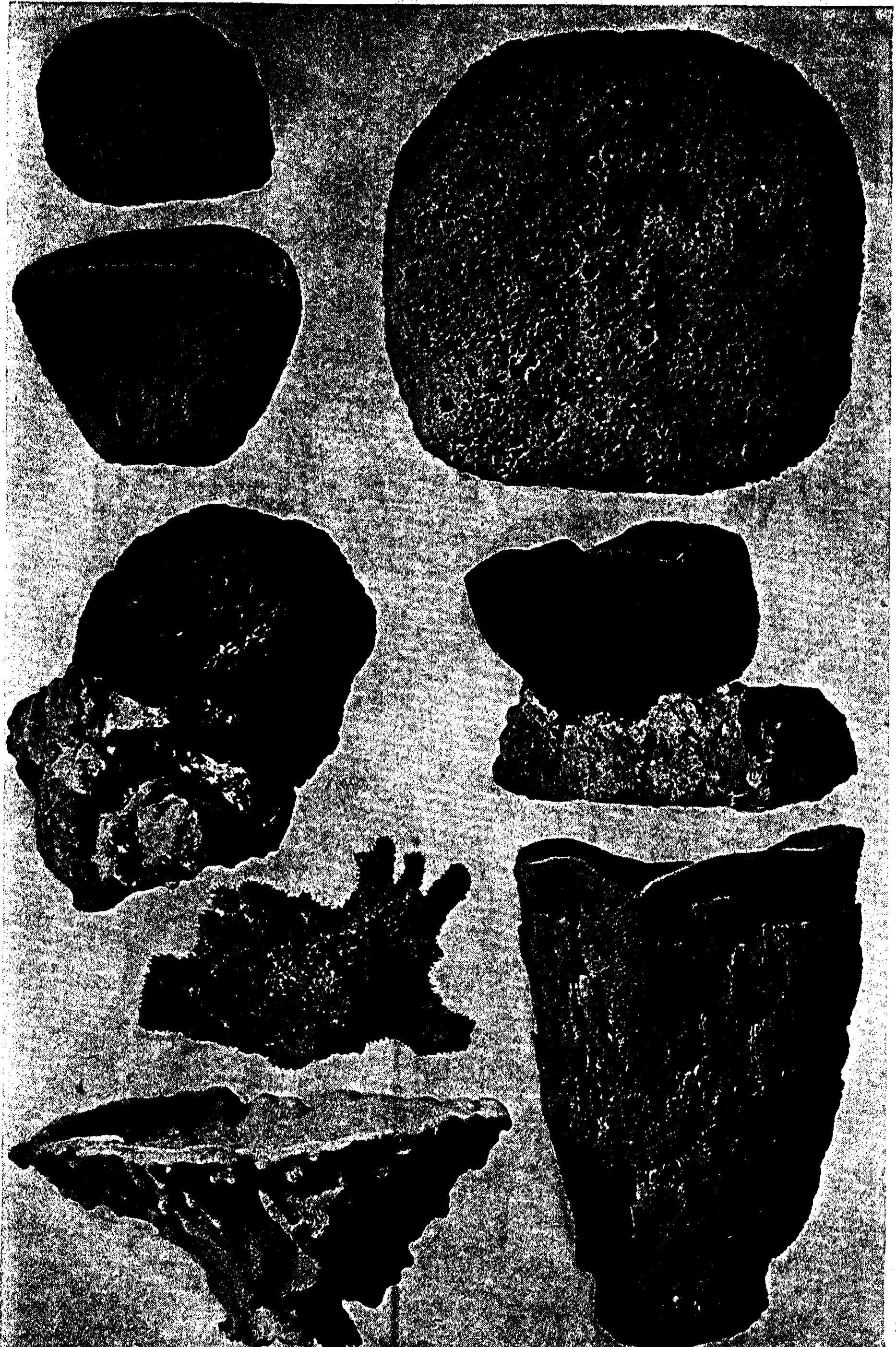
CONTINUED FROM 4246

THE Greek and the sponge are closely connected. Long, long ago in the clear rock-sown seas around Greece the young Greek diver toiled to bring up the curious sponge masses; the ancient warriors used sponges to pad their helmets; Greek merchants brought sponges into the London market early in the nineteenth century, and Greek divers, who have learned their art in the Mediterranean, are the chief sponge fishers in the waters of the Gulf of Mexico to-day.

Less than a century ago all the sponges used in this country were imported from the Mediterranean and Red Seas; to-day many of them come from the warm clear waters off Florida, in the Gulf of Mexico, and the West Indies. When they were first found growing off the island of Key West the sponge fishermen used to go out, two in a small boat, to fish for them. The man in the stern sculled the boat, and the one in the bow hooked the sponges. The hooker was armed with a long hook, 45 or 50 feet in length, and with water-glasses, a bucket with a glass bottom tied to the side of the dinghy. Pushing the water-glass beneath the ripples on the surface, the hooker rested on the thwarts facing towards the bow and pushed his head as far down into the bucket as possible. As soon as he sighted a sponge, he dropped the water-glass and grasped his hook with both hands. A little hoist and he landed a fine sponge in the boat. His mate, meanwhile, was sculling very smoothly and gently along, so as not to cause the hooker a strain, or cause him to lose his balance.

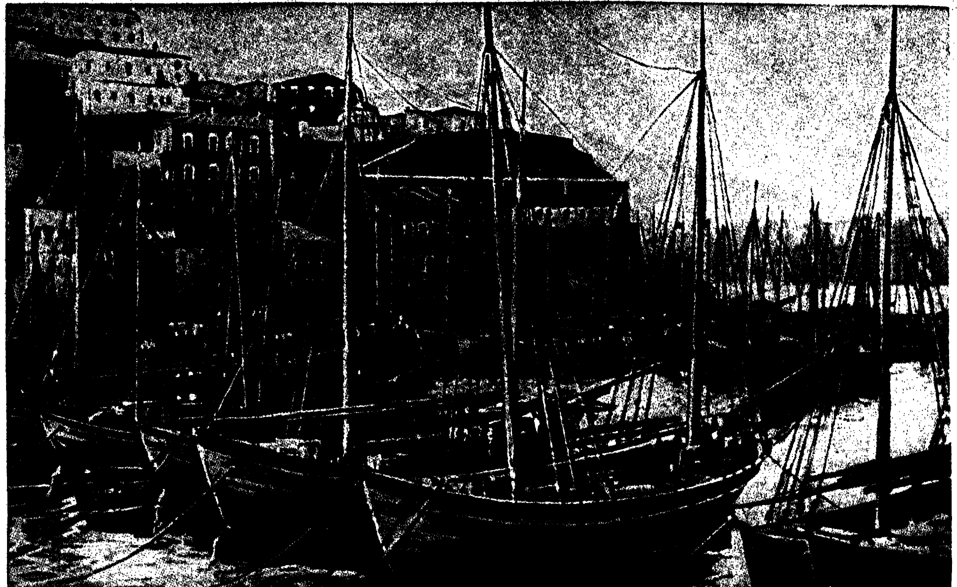
To-day, however, most of the sponge fishing is done by expert Greek divers, clad in the most modern diving suits and carrying with them mesh bags in which to collect the gluey, strong-smelling masses. The water in which the diver works is so clear that there is little danger except from sharks, which abound. These he cannot attack with a knife for the scent of blood would draw others to the spot: all he can do is to remain perfectly still, for the shark will soon leave anything that seems dead. Basket after basketful is drawn up to the boat above and then the sponges are carried to the big ship, where they are spread on deck until the slimy matter has drained out of them. While this dying process is going on, the sponge gives off a very strong, disagreeable odor which gradually lessens till it resembles that from seaweed. When the schooner has made her haul, she returns to her port, and the

THE LIFE OF A SPONGE

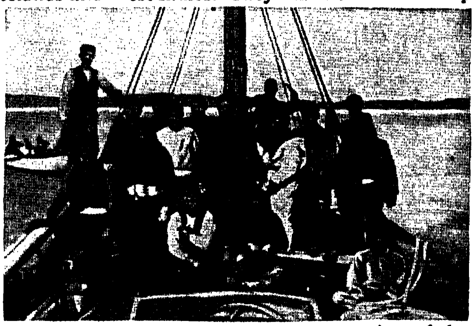


It is odd to think that the sponge we use in the bath was once alive, but so it is. The sponge lives in the sea, and breathes oxygen like a fish. Water is drawn into it through little pores, and the food the water contains is devoured by cells, and the water passes out by the large holes which we see in the sponge. They are really canals, and in them worms and tiny shell-fish, and even small crabs, make their homes.

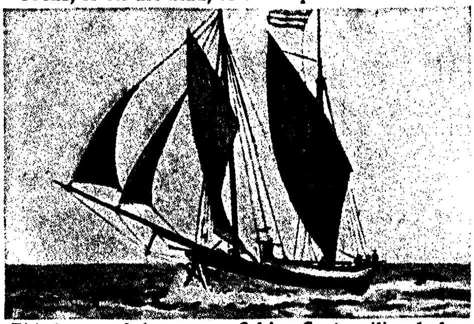
WHERE THE SPONGES COME FROM



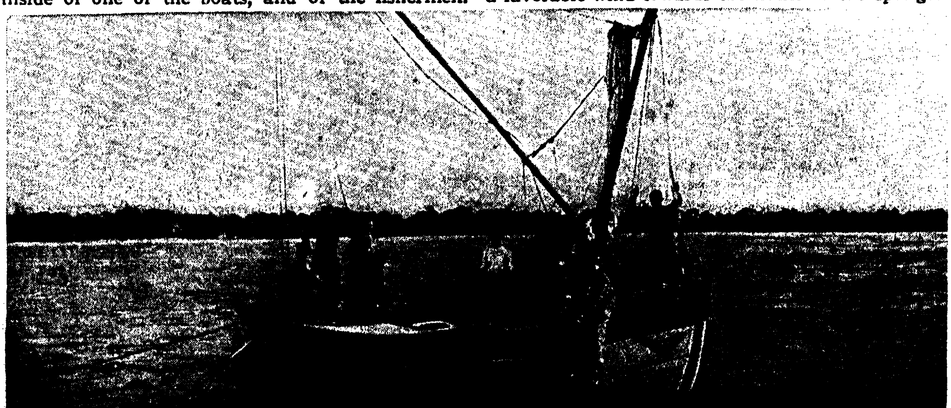
Here is a sponge-fishing fleet being got ready in the harbor of Hydra, Greece, to sail for sponge-fishing. The sponges live in warm, tideless seas off the coasts of Turkey and Greece, off Florida, and off the Bahama Islands and West Indies. They make their homes upon rocks, or on the mud, or even upon other animals.



The fleet has started, and here we get a view of the inside of one of the boats, and of the fishermen.



This is one of the sponge-fishing fleet, sailing before a favorable wind towards the home of the sponges.

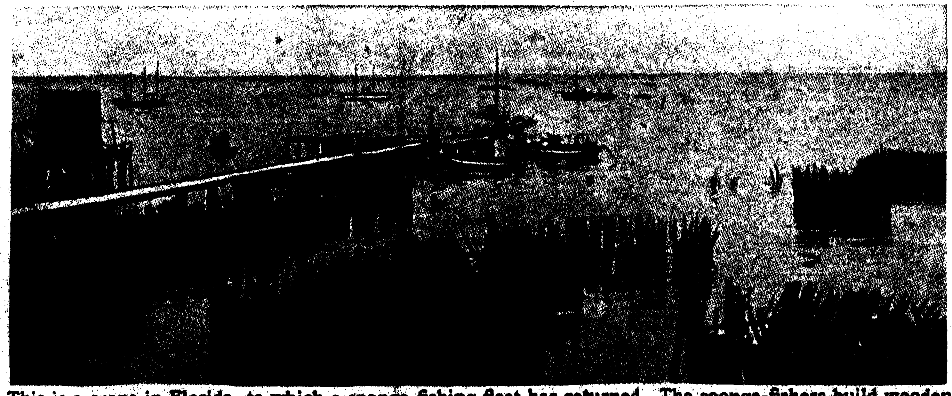


This boat has reached the fishing-ground, and a diver is going down to drag up the sponges that lie from 40 to 60 feet below the surface of the water. The tube which we see to the left of the diver will send down fresh air for him to breathe. He will uncoil the rope in his hand so that it may serve as a guide to him in the water, and by jerking the rope he can signal to his comrades to pull him up with his sponges.

THE SPONGE-DIVERS AT WORK IN THE SEA

Here we see the boats on the sea, and the divers in the water, stripping the sponges from the rocks. The men who wear diving-dress can stay under water for hours. The man who is diving from the boat on the left has no diving-dress. He will not be able to stay in the water more than two or three minutes.

Here the sponges are being roughly cleaned after being brought ashore by the boats. There is a thin skin over the sponge, and in all the pores and canals is a slimy, sticky substance, which is the life-matter of the sponge. The skin has to be removed, and the sticky substance squeezed out to fit the sponges for sale.



This is a scene in Florida, to which a sponge-fishing fleet has returned. The sponge-fishers build wooden enclosures in the water, which we see here, so that in them they may store their newly-caught sponges. The action of the water makes it easier for the fishermen to remove the slime and skin of the sponges.

sponges are put in kraals like those shown in the picture—in order that the tide may wash them out thoroughly. Afteı a week in the kraals each sponge is taken separately, and squeezed, and beaten with a stick till all the living matter has disappeared. Finally, it has to be bleached, and, according to its kind, this is differently done. The fine sheepswool variety is washed in very soapy water, and hung in the air and sun and dew, covered with soapsuds. The more common yellow sponge is bleached with a solution of lime, or an acid and sea water, although acid sometimes weakens the fibre of the sponge.

Here are the sponges brought in from the fishing-ground at sea by the two boats on the left and right of the picture. They are big, good sponges, which have been gathered by hand from the depths of the sea. Some divers tear the sponges away with pronged forks, but this spoils them, and reduces the price.

The photographs in these pages are supplied by Messrs. Cresswell Brothers & Schmidt, London.

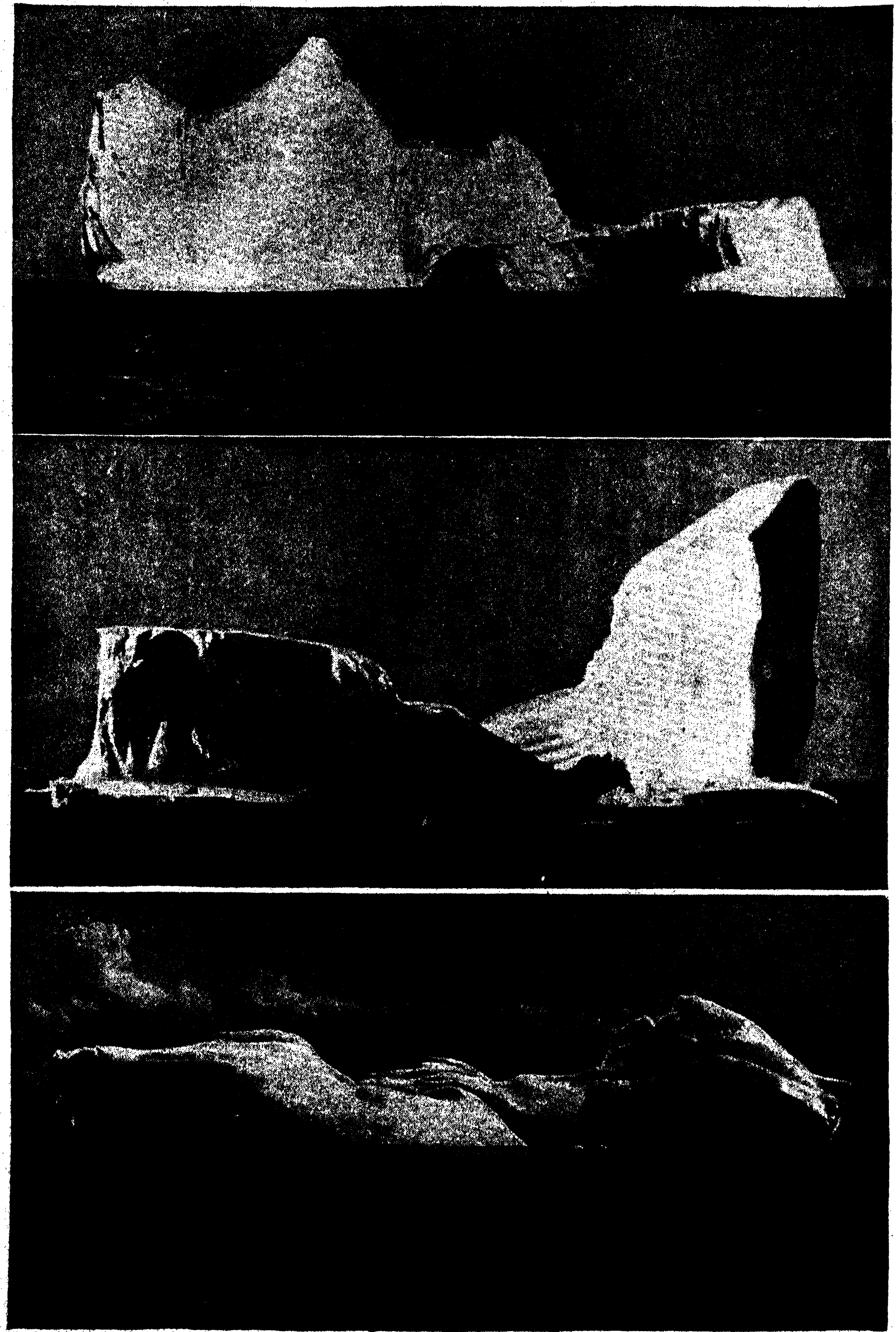
Though most of the sponges used in America come from the waters around Florida or the West Indies, the finest quality comes from the Mediterranean and the Red Seas, where sponges have been gathered from the same waters for many centuries. The sponges of the Western World are generally coarser than those of the East. Though sponges are not used so much in surgery or in the bath as in former times, new uses have been discovered, and the demand continues heavy.

The beds of sponges are rapidly becoming depleted because they are constantly fished, without allowing time for the young sponges to mature. Because of this the United States government has passed laws forbidding divers to take sponges between the 1st of May and the 1st of October. Revenue cutters have authority to seize boats engaged in fishing during this close season. Further, the cultivation of sponges is being seriously considered, although as yet the process for growing them costs too much for commercial purposes.

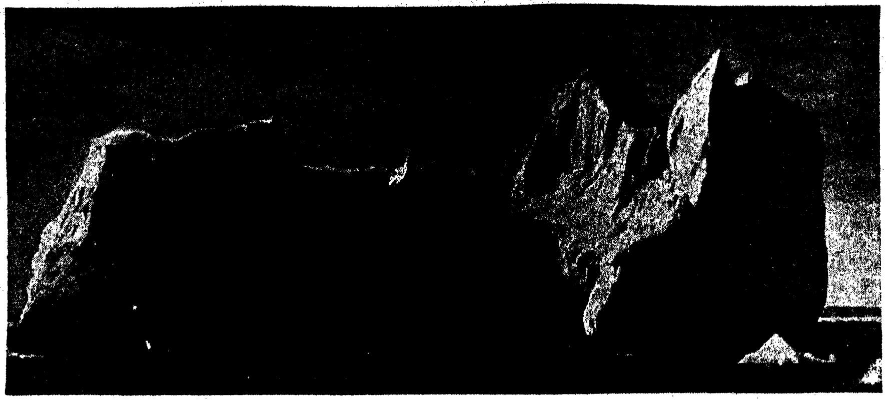
Bits are cut from a live sponge, and each of these is fastened to a sort of base, usually made of cement. This is sunk into shallow water, and the sponge may grow so rapidly that it may be taken up the next year, or in two years at most. Some of the sponges die, however, and some of the bases are lost, so that the expense is large and not many sponges are yet grown in this way. Some day we may have to depend upon this method if the public waters are fished so constantly. Perhaps some kinds of sponges may be reared from their eggs.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 4453.

MOUNTAINS OF ICE FLOATING IN THE SEA



Here we see some of the fantastic forms taken by the great icebergs that float down from the north into the Atlantic and Pacific Oceans. Icebergs have the appearance of dazzling chalk cliffs. Their height above water is sometimes 250 feet, which means that under water they reach to a depth of more than 2,000 feet. Icebergs often carry to sea boulders and piles of smaller stones, and even Polar bears are sometimes seen making a dangerous voyage on an iceberg. When the ice melts they sink in the sea and are drowned.



WHY DOES AN ICEBERG FLOAT?

CONTINUED FROM 4117

IF we were to judge by almost every other case we know, we should say that an iceberg must certainly sink. The rule is that when anything is cooled it becomes denser—that is to say, heavier in proportion to its size. In other words, it contracts. If this were true of water, ice would have to sink, and our earth would not be the earth we know.

Water certainly contracts as we cool it down to four degrees centigrade above the freezing-point. But from this point downwards water expands instead of contracting, so that ice is slightly lighter than the water around it. The difference is not very great—it is just enough to allow an iceberg to float with about seven-eighths of itself below the surface of the water and one-eighth above it.

In the Antarctic Ocean one may see icebergs that are actually miles across, and they may rise two or three hundred feet above the surface of the water. But the laws that govern floating must always be obeyed; and if we remember that there must be seven times as much ice below the surface as shows above it, we shall get an idea of the enormous size that masses of ice sometimes attain. The part below the surface is, of course, surrounded by liquid water, which is warmer than the ice. Consequently, by the laws of heat, there must be a flow of heat from the water to the ice, which therefore melts. The result often is that, after a time, owing to the destruction of the foundations, so to speak, the iceberg capsizes, and a new part of itself shows above the surface.

It has been lately proved that when ice is made very cold indeed, a point is reached when it begins to behave as other things do, and shrinks as it cools. But, fortunately, this point is far below any temperature that occurs naturally on our earth, and so it is not so important.

HOW DO FISH LIVE IN A FROZEN POND?

Ordinary ice, we know, is lighter than water, and therefore it floats. So what we call a frozen pond is a pond of which the surface is frozen. Skaters are perfectly aware of this. They want to know how thick the ice is, for they know that there is liquid water underneath it. So when we speak about fish living in a frozen pond, we mean fish living in liquid water that has a layer of frozen water above it.

The really serious part of this for the fish is not, as we might think, the coldness of the water in which they are, but the question how that water is to be supplied with enough air to enable

the fish to live. When a pond is not frozen, oxygen from the air above it is passing into the surface of the water as fast as it is being used up by the fish and other living creatures in the water.

When a pond is frozen, this process is very nearly stopped. There may be gaps in the ice here and there—air-holes, such as air-breathing creatures will make in the frozen North—but perhaps there may be none of these. A little oxygen may get through at the edge of the ice, but the best hope for the fish is that there is a supply of new water coming into the pond below the ice from somewhere else, and bringing enough oxygen dissolved in it to keep the fish alive. If the supply of oxygen is kept up in none of these ways, then, when there is no more of it left, the fish will surely die, as must every living creature that is prevented from breathing, whether it be man, mammal, bird, reptile, fish, moss, or microbe.

HAVE FISHES ANY FEELING?

Certainly they have. Everything that lives, from a microbe up to a man, has some kind of feeling. The power to feel and to respond to what is felt is a mark of all living matter everywhere, and its disappearance without return is the mark of death. But the amount and the quality and the clearness of feeling differ widely in various living things. So it would be equaly wrong to say that a fish has no feeling, and to say that it feels as we do. It does feel, but it does not feel as we do.

Seeing is a kind of feeling, and perhaps a fish sees quite as well as a young baby does. A fish hears, too, and smells and tastes. Also, a fish certainly has the sense of touch. It can suffer a kind of unpleasant feeling, too, and must do so, for instance, when it has a hook in its mouth; but it would be a great mistake for us to fancy that it feels sharp pain as we should if we had a barbed hook in our mouths.

A fish has only a very simple kind of brain, and cannot feel so keenly as we do. So as to whether it is right to fish, I think we should decide for ourselves, and act accordingly, but not condemn or ridicule people who differ from us in their opinion on the matter.

WHY IS SUGAR SWEET?

This is a question which can be answered *in a way*; and yet cannot be really answered at all. We know that there is a certain well-marked part of the surface of the brain which is the real seat of the sense of taste. From, or to, this place there run at least four, perhaps more, sets of nerves, which at their other ends we find in the "taste bulbs" of the tongue and part of the throat. One set of these nerves, when it is excited, arouses in the brain the feeling which we call a sweet taste, and the thing which specially excites this particular set of nerves is sugar. So, *in a way*, that is the answer to the question.

But no one has the least idea why sugar should not taste salt, or why salt should not taste sweet or bitter; nor is there any imaginable way of describing a sweet, a salt, or bitter, or acid taste to anyone who does not know these tastes. We cannot even know that other people taste sugar or anything else just as we do.

"Sugar" is really a name for a closely related group of chemical substances, all of which are sweet tasting, though some are less so than others—for instance, milk sugar. But saccharin, which some people use instead of sugar, is utterly different from sugar chemically, yet it is sweeter than any sugar.

WHY DOES HOT WATER CLEAN THINGS BETTER THAN COLD?

When things are dirty, especially our skin, or our clothes, or the plates we have eaten from, the chief cause of the dirt, and the chief difficulty in getting things clean, is fat or oil. If we try to clean an oily plate with cold water, we cannot doubt this. Fat and oil are great catchers of dirt, and if we wash our fingers perfectly clean, and then rub a little butter on one hand, but not on the other, five minutes will show a great difference between the two hands.

Fat is simply solid oil, and oil is liquid fat. Whether the thing shall be solid or liquid is decided by the amount of heat in it. If it is hot, it is liquid, and then it can easily be got rid of. Hot water turns solid fat and half-solid fat into a liquid oil, and that is the reason why it cleans things better than cold water.

If the thing we have to clean has no fat or oil in it, we shall find that whether we use hot or cold water matters very little. But the mere fact that we commonly use our bare hands for washing things makes hot water more useful,

as our hands themselves are producing a quantity of fat or oil all the time except when they are bitterly cold.

WHY CANNOT ORDINARY GLASS BE BENT?

All we can say is that different kinds of matter have different properties; some matters will bend, or be hammered into thin sheets, or be drawn into long wires without breaking, while others will not. The differences depend on the way in which the molecules of the thing in question are joined to each other. Glass is one of the things that are rigid and brittle, while clay, for instance, can be bent or molded into any shape.

But it is very interesting to find that the same thing may sometimes be brittle and sometimes plastic, according to circumstances, and the most important of these circumstances is the temperature. Glass itself gives us an instance of this. It is quite true that glass, as we know it, will not bend—or, rather, that it will not bend much.

If we make the glass hot—red hot, or a little less than red hot—it will bend quite readily into any shape we please. Then we can cut it with scissors, or draw it out with pincers, or mold it into any shape we like. This is the general rule with a great many things which are rigid and brittle when they are cold. It must mean, of course, that when the glass is made very hot, its molecules do not hold on to each other so tightly as they do when they are cold.

WHY DOES THE STREAM RUN MOST SWIFTLY IN THE MIDDLE?

The water at the side of the stream is constantly being held back by rubbing against the banks, just as the bottom of a wave is held back when it reaches the shallow water near the shore. And so, compared with the water near the sides, the water in the middle of the stream runs more swiftly. It is held back a little by rubbing, or friction, between it and the slower moving water at the sides; but the friction between water and water is very much less than the friction between water and anything that is solid, such as the banks of a stream.

When we watch the blood running in a blood-vessel, we see exactly the same thing. In the middle of the stream we see the tiny red and white cells tumbling fast over each other as they scurry along. But near the walls of the blood-vessel they move much more slowly, for they are held back by the friction of the wall, even though it is beautifully smooth. And just the same thing happens with smoke going up a chimney, and in many other cases. We should always try to think, when studying such a question as this, of other cases where the same principle of friction is really at work.

WHY DOES BOILING MILK FLOW OVER THE TOP OF THE SAUCEPAN?

When any liquid boils, what happens is that parts of it are changed into a hot gas. This is much lighter than the liquid in which it is formed, and so it rises to the top as a bubble, and there the bubble bursts and the gas is given off into the air. When a bubble formed at the bottom rises through the liquid unbroken until it reaches the top, and bursts there, we say that the liquid is boiling.

In the case of water, which is all made of one thing, there is nothing to prevent the bubble from reaching the top of the boiling water and bursting there. So, though the surface is raised everywhere for a moment by bubbles which have half freed themselves, the water does not boil over. But milk is a mixture of a great many different things, some of which can boil, and some cannot. What really boils in milk is the water, which, after all, makes up the greater part of it.

At least one of the things in the milk turns solid and forms a skin on the top of the milk when it is heated. This skin is made of one of the valuable proteids of the milk, and it is great waste not to eat it. Now, when the bubbles of water-gas reach the surface, they find themselves imprisoned by this solid skin that is forming, and they lift it up, just as the hot air may lift a toy balloon, so that, as we say, the milk boils over. If we carefully stir it, we may prevent this.

IS A FLY, IN COMPARISON WITH A MAN, REALLY THE STRONGER OF THE TWO?

Everyone will know what this question means, and yet it is not quite rightly put. So far as the words go, the question might mean, if you compare a fly and a man, which is the stronger? But we know that what the question really means is this: "Is a fly really stronger than a man relatively to its size, or in proportion to its size?" The answer is certainly yes. The last thing in the world that distinguishes

man is bodily strength of the kind which is shown in lifting weights, and so forth. It is by *skill*, made not by the muscles, but by the brain, that man lives on the earth—skill, not strength. If we weigh the proportion of the bodies of different animals that is made of muscle, and if also we weigh the proportion that is made of brain, then we learn how muscle has been getting less and less important, while brain, with all that brain means, has been getting more important. Not only a fly, but animals in general are the superiors of man so far as muscular strength is concerned; but then the question of muscular strength is an inferior one, and man is master because of what really matters, which is mind. The race is not to the swift, nor the battle to the strong, but to the wise, who will use their brains.

WHAT MAKES THE WHITE MARKS ON OUR NAILS?

Our nails are made of a very special kind of horny material. It is in some ways like the material that makes the outer skin; it is also still more like part of the material that makes the hair; but it is different from either of these, and comes closer to horn than any other part of our body does. It is made by special cells of the deeper part of the skin at the base of the nail, and our nails, therefore, depend entirely upon the perfect health of these cells.

In cases where a person's skin is not in health, it is very commonly found that the nails suffer, dropping out or becoming cracked or brittle; and if for any reason the blood is out of order, and so supplies what is not quite suitable, or may even be poisonous, to the cells at the base of the nail, their work will be interfered with, and though they may go on producing nail stuff, it will not be quite what it ought to be.

In this way we can often see white marks across the nails, sometimes on all the fingers of both hands, corresponding to the date when we were out of health, and when the proper nail substance could not be made. The toenails may also show indications of these white marks, as we should expect.

WHAT IS AT THE END OF SPACE?

It is not often that we can answer a question about the outside world by looking into our own minds and seeing what they tell us. Indeed, for many ages the progress of knowledge was stopped because men thought they could discover things out of their heads instead of looking to see what Nature said. But this is a question which we can answer out of our heads; we do not need to go to the end of space to answer it. We find, directly we begin to think of the end of space, that there must be more space beyond it. It is impossible for our minds to think of the end of space. Directly we try to do so we are bound to think of more space beyond it. There is no way out of it. In the same way, we cannot think of the beginning nor yet of the end of time. However far back we like to go in our minds, there must have been a time before that, whatever it was; and so, if the world came to an end, as we say, there would still be the time after that event happened. We are bound, by the very nature of our minds, to think of space as infinite, and of time as infinite, too. *Finis* is Latin for end, and infinite literally means unending.

WHY DO WE GET A HEADACHE IN A CROWDED ROOM?

We do not get a headache in a crowded room if it is properly ventilated; only, of course, it never is, and if any one of us is the only person in the room, a headache will very likely come on if the room is small and shut up so that the air cannot be changed. There is no question that it is the foul air which causes the headache. The reason why the crowding of people together has this effect is that it is the people themselves who make the air foul.

Every living thing, without exception, gives off to its surroundings, in one form or another, products of its life which are worse than useless to it, and which it must get rid of. The most elegant people, spotlessly clean and perfumed, are no exceptions to the rule. There is a good deal of doubt as to what precisely the things are which produce the effects of foul air. It is possible that gases given off from the skin, especially if it is not very clean, may contribute.

The chief external causes of headache in a crowded room are excessive heat and moisture, acting together, for either alone does not seem to affect us to any great extent. Heat and moisture interfere with the normal or proper action

of the skin. The active purpose of our skin is to keep the temperature of the body within certain limits by the evaporation of moisture from the skin. If this is stopped the temperature of the body rises, and the skin makes an effort to throw off water by increasing the flow of blood to the skin. In so doing it draws away the supply of blood which should go to the brain and other organs. These are so much disturbed by the action of the skin, that there can be no doubt that the headache is caused by these disturbed organs.

WHY DOES THE HAIR STAND ON END WITH FRIGHT?

We know that both in ourselves and in many of the lower animals the hair can, and does, stand on end with fright, almost "like quills upon the fretful porcupine," as Shakespeare says. It is also true, as he says, that it is possible for "each particular hair to stand on end," for we find that every hair has the power to do this, and that what happens is not that several hairs stand up together as the result of pulling on the skin. At the root of the hair we find a tiny muscle so arranged that, while the hair usually lies slantwise, when this muscle pulls, the hair stands upright.

The best reasons we can give for this peculiarity are that this movement may help to keep the root of the hair in order by a sort of massage, or that it may serve in keeping the skin clean, or, most likely of all, that it may make such an animal as a cat, when its hair is standing on end, look very much bigger and more terrible to an enemy.

WHY DO WE FEAR BEETLES OR SPIDERS WHEN WE KNOW THEY CANNOT HARM US?

This is one of the most interesting of questions, because the answer to it takes us right into the depths of the mind. What we call reason, or intelligence, is in many ways the highest part of the mind, but it is not the whole of it. It is, in a sense, a new thing, and its power is limited by the fact that there are other parts of the mind, far more ancient, which have to be reckoned with as well. Most of these we may simply call instincts, and again and again we find, when we observe ourselves and other people, that the instinct of curiosity or of flight decides our actions quite apart from our reason, and quite apart from what we know, or do not know, in the particular case. Very often indeed the part of us that knows does little more than just sit still, so to speak, and look on and notice what the rest does. If we think, we shall see that we could not live if we had only our reason. To begin with, a baby would not suck, for there would be nothing to make it do so; and so it would be in a hundred ways throughout life.

But often our instincts may mislead us, though usually they guide us rightly, and so we may have the instinct of flight and the feeling of fear, which goes with it, when we see a beetle or a spider; and then we may be able to notice that, whatever the knowing part of us says, there is something else in us, older and stronger, which has its way and makes us afraid. Even now it is highly desirable that we should dislike crawling and creeping things; many may be harmless, but many others are dangerous in various ways; and, on the whole, this instinct is a useful and wise one for us to have.

WHAT MAKES THE POISON IN A SNAKE'S FANG?

A snake's fang is an eye-tooth, or canine tooth, as it is called, corresponding to the sharp pointed teeth that we have at the corners of the jaw between the front teeth and the back teeth. In the case of the poisonous snakes, the tooth has a special channel in it through which the poison can run when the snake bites. The snake, like ourselves, has certain glands, but in our case these simply produce the saliva, which helps us to chew and digest our food.

In the snake, however, these glands do much more than that, and especially the gland which corresponds to the one we have in front of the ear, the one which becomes so swollen and painful if we have mumps. In the snake the business of this gland is to produce poison. The poison runs along a little tube from the glands on each side of the mouth to the poison teeth. When the snake bites, the muscles of the jaw, which make the teeth meet, also squeeze upon the glands in these tubes in such a way that a little of the poison is forced through the channel in the fang, and left in the victim's body. The amount of poison

thus injected is, as a rule, exceedingly tiny, but the venom, or poison, of many of the venomous snakes is among the most deadly of all poisons, and a tiny portion of a drop will kill. This is a deeply interesting question from the widest point of view, because it is so remarkable to discover that, in certain kinds of animals, parts of the body which are possessed by so many other kinds of animals, and which were certainly evolved for one purpose in the first place, are turned to a quite new and special purpose in these particular cases. In non-poisonous snakes, these same glands, which are so poisonous in the venomous snake, look just the same, yet produce nothing to hurt anyone.

HOW DID ALL THE METALS GET INTO THE EARTH?

If this question had been asked some years ago, no one could have made any better answer than that the various metals were in the stuff from which our earth was formed ages ago, and that by some chance or other they just settled down in the earth's crust—one here and one there. But quite lately we have had to give up for ever ideas of this kind.

We are beginning to understand that change is going on everywhere. This is true of worlds; it is true of plants and animals; it is true of nations and their ways; and, for instance, it is true even of the atoms of the elements. So now, when we find gold in some part of the earth's crust, or silver, or lead, or whatever it be, instead of saying that these were always there, we inquire into their history and find out how they came to be made, just as if we were studying the remains of some animal or plant.

For instance, we have little doubt that all the lead in the world is the result of a long series of changes that began in an element called uranium, and that stages in between uranium and lead are represented by the element called radium and the beautiful and precious metal which we call silver. It may not be very long before chemists are able to work out the history of many metals, and even to discover what will happen to them next.

WHEN WE DIVE WHY DO WE ALWAYS RISE TO THE SURFACE?

This is not a very easy question to answer. For one thing, it is possible to dive and not rise again. This may very easily happen when a man dives from a height into shallow water, and does not do the right thing when he gets under. He may then strike the mud at the bottom and stay there. That is the danger of diving from too great a height into shallow water. In such a case the diver's body would naturally go deeper than the water before it came up again. The secret of his success is that he turns his hands after he enters the water, and so changes his course.

Apart from this, the reason why the diver comes up again is to be found partly in the action of his arms and legs under the influence of the powerful instinct to get to the air again, and partly in the elastic rebound of the water after he has struck it. We must also remember that the pressure of the water becomes greater with every descending foot; and the diver's body, filled as his lungs are with air, is scarcely, if at all, heavier than the water itself.

The case at once becomes different if he is injured, or if he is a drowning person unaccustomed to water, who breathes out into the water the air of his lungs, and then breathes water in. That is quite as bad as letting water get into the air-tight compartments of a boat.

DOES A TADPOLE KNOW IT WILL LOSE ITS TAIL?

Certainly we cannot speak of a tadpole, or any such creature, knowing anything in any such way as this question suggests. A tadpole, a fish, an insect may know, in the sense of recognizing, a thing that it has seen before, and remember whether it is nice or nasty. A dog, an animal of very high intelligence compared with a tadpole, may know when its master is angry; may know when it is doing a thing which is disapproved of. But not even a dog can ever *know* in the sense suggested by this question.

Let us consider what the point is. If a tadpole is to know that it will lose its tail, this means that it has arrived at the idea of itself as I, and that it is able to think of itself in the future and what will happen to it. In other words, the tadpole must be conscious of itself. But this consciousness of ourselves, or self-consciousness, is found in no living creature but man, and is, beyond all other things put together, the fact which distinguishes man from every other form of life on the earth.

Even a human baby does not have self-consciousness. Tennyson has said:

> The baby new to earth and sky
> . . . .
> Hath never thought that this is I.

When a baby learns to talk, it first speaks of itself as baby, and only gradually discovers itself, and speaks of I. Then it has become really human. If a tadpole knew that it would lose its tail, the power to do that would at once place it on a level with ourselves: it would be no tadpole.

WHAT MAKES THE CATERPILLAR TURN INTO A BUTTERFLY?

Whenever we ask about any fact of a living thing, we have to make our choice and balance more or less between the effects of its own nature and the effects that its surroundings work upon it. In the case of this question, everyone will agree that the important thing is the nature of the caterpillar.

By altering its surroundings as regards temperature, light, moisture, and so on, we can hasten, or retard, or slightly affect in other ways, the change that occurs to the caterpillar. But such experiments as this only make it more clear that the real cause of what happens is to be found in the nature of the caterpillar itself. Now, if we look at a caterpillar and do not think of what it will become, we shall agree that it is in most respects a sort of worm. On the other hand, if we look at the butterfly and forget what it was, we shall agree that it is a sort of insect.

There is a vast difference between a crawling worm and a flying insect. Now, if we look at a tadpole, we shall agree that it is a kind of fish, breathing the air dissolved in water, like other fishes; but a frog is no fish, and breathes air as we do. The explanation, we believe, is that the frog, and all creatures like frogs, are descended from fishes, and so in its earliest stages each of them is a fish. So also we are bound to believe that the insects are descended from the worms, and that is why the caterpillar turns into a butterfly. In a large book it might perhaps be possible to begin to do justice to this question.

WHY IS IT DARKEST JUST BEFORE DAWN?

We ought to begin by asking: Is it darkest just before dawn? There is probably very little ground for this belief. At any rate, we may be quite certain that in all cases like this, where we compare darkness and light, or loudness and softness, it does not do to trust to the evidence of our senses, because they do not judge fairly.

There are various ways by which we can measure the brightness of light. In order to prove that it was darkest just before dawn, it would be necessary to use some kind of light measurer—not our eyes—and compare the amount of light it recorded just before dawn with what it recorded previously. Our eyes and senses in general do not judge things on their own merits, but always by comparison with other things.

The proper way to say this is that all our sensations are relative. A room may be light relatively to a room that is less light. If we go to the room from darkness we call it bright; if we go to the room from blazing sunlight we call it dark. And so we judge the darkness before dawn by the dawn. When the light begins to come into the sky, we think how very dark it was just before.

WHY ARE THE NAMES OF CHEMICALS AND PLANTS WRITTEN IN LATIN?

Latin is now what we call a dead language—that is to say, no living nation speaks Latin, though, in point of fact, one-third of English, for instance, is really Latin. The time was, of course, when Latin was a living language, spoken by the most important people on the face of the earth at that time. They had names for many chemicals and plants, many of which names we use to-day.

But long after the downfall of Rome, Latin remained the language of scholars; it was the one language known to all learned men all over the civilized world; they always wrote their books in it, and lectures were always delivered in Latin. It was thus possible for an Italian, shall we say, to visit England and lecture to the Englishmen at Oxford in a language which was neither his own nor theirs, but the common tongue of the learned.

So it naturally came about that when the great Swede Linné, usually known by the Latinized form of his name, Linnæus, began to name and classify plants, he gave them Latin names. The convenience of Latin for such purposes is as great now as ever it was.

THE NEXT QUESTIONS ARE ON PAGE 4369.

THE WOLF CAME BACK AGAIN TO THE HOUSE

" Dear me, how late you are ! " said the pig when he saw the wolf. " I've been back an hour or more. I'm sure I'm much obliged to you ; they were fine turnips ! " The wolf was furious, but pretended not to mind.

THE THREE LITTLE PIGS

CONTINUED FROM 4239

ONCE upon a time, three little pigs went out into the world to seek their fortunes. The first little pig had not gone far before he met a man who was carrying a bundle of straw.

"If you please," said the little pig, "will you give me some of that straw to make me a house?"

"With pleasure," replied the man, and away went the little pig with the straw, and built his house.

Now, an artful old wolf who lived near by determined to have the little pig for supper. So when it became dusk he went up to the little straw house and called out:

"Little pig, little pig, may I come in?"

But the little pig knew his voice, and said:

"No, no; by the hair on my chinny, chin, chin!"

"Ho, ho!" cried the wolf. "Then I'll puff and I'll blow till I blow your house in."

And he puffed and he blew, and he puffed and he blew till the house fell down. Then he sprang inside, pounced on the little pig, and gobbled him all up.

The second little pig met a man carrying some sticks.

"If you please," said the little pig, "will you give me some of those sticks to make me a house?"

"With pleasure," replied the man. Away went the little pig with the sticks, and built himself a cosy house.

That night the wolf came to the door.

"Little pig, little pig," cried the wolf, "may I come in?"

"No, no," replied this little pig, as the other one had done; "no, no; by the hair on my chinny, chin, chin!"

"Ho, ho!" cried the wolf in a rage. "Then I'll puff and I'll blow till I blow your house in."

And he puffed and he blew, and he puffed and he blew till the house fell down. Then he sprang inside, pounced on the poor little pig, and gobbled him all up.

But the third little pig was exceedingly wide awake the morning *he* set out on his travels. This little pig went on till he saw a man carrying bricks.

"If you please," said the little pig, "will you give me some of those bricks to make me a house?"

"With pleasure," replied the man, and away went the little pig with the bricks, and built his house.

Soon the old wolf came along that way, and knocked at the door.

"Little pig, little pig, may I come in?" he cried.

"No, no," cried the little pig; "no, no; by the hair on my chinny, chin, chin!"

"Then I'll puff and I'll blow till I blow your house in!"

But the house was made of bricks, and the old wolf he puffed and he

blew, and he puffed and he blew, and still the house stood firm. At last he went away in a rage; but presently he came back again.

"Little pig, little pig, I know a field just down the lane where there are such fine turnips. I'll call for you in the morning and show you the way."

The next morning when the wolf called out: "Are you ready, little pig?" the little pig replied: "Dear me, how late you are! I've been back an hour or more. I'm sure I'm much obliged to you; they are fine turnips!"

The wolf was furious; but, pretending he did not mind, he said, quite pleasantly:

"Do you like apples? I know an orchard down the lane where the trees are covered with fruit. I'll call for you in the morning, and show you the way."

The next morning the wolf got up very early, and walked round to the little pig's house. But the little pig must have got up earlier still, for when the wolf arrived he found him out.

The wolf hurried off to the orchard; but the little pig saw him coming, and climbed up into a tree.

"These are indeed fine apples," he called out, as the wolf came up to it. "Just try this one." And he threw the apple as far away as he could into some long grass. Then, while the wolf was hunting for it, the little pig scrambled down the tree, and ran home.

The wolf did not like being beaten, so the next morning he went again to the little pig's house, and said:

"Little pig, little pig, there's going to be a fair on the village green this afternoon. You come along with me, and we'll both have a fine time. I'll call for you at exactly three o'clock."

The little pig said nothing, but at half-past two he started off for the fair. He bought a churn, and was rolling it home when he saw the wolf in the distance. Quick as lightning the little pig jumped into the churn to hide, and set it rolling down the hill. The hill was steep, and the churn came flying along at such a speed that the wolf became frightened, so he turned back and ran home as fast as he could.

Some hours later, when he felt braver, he went to the little pig's house.

"I was just on my way to call for you this afternoon," he shouted out, "when I met the most awful thing rolling down the hill all by itself. It gave me a horrible fright, I assure you. There must have been a witch inside."

The little pig burst out laughing, and he laughed so loud and he laughed so long that the old wolf was annoyed.

"I was the old witch," said the little pig, as soon as he could speak. "I spied you a long way off, and I jumped inside to save my skin."

This so enraged the wolf that he jumped up on to the roof and began sliding down the chimney. But it was baking day, and the little pig had made a huge fire. Down, down, down slid the wolf; there was nothing to save him. He sank right down into the fire, and was burned to cinders. And that was the end of the old wolf.

THE DOG THAT REMEMBERED ODYSSEUS

WE have read some stories about the hero Odysseus, who is sometimes called Ulysses; and this is the story of his dog, whose name was Argus. Before Odysseus went away from his home in Ithaca to the great war with Troy, there was a puppy born, which grew to be a noble hound.

Odysseus loved Argus, and Argus loved his master. The hound would prick up his ears and give a joyful bark when his master approached. Then he would look at Odysseus with a world of love reflected in his eyes, and raise his head for the caress which always followed.

As Argus grew older he seldom left Odysseus for long. Like a shadow, he followed his master everywhere, except upon very long journeys. But before the hound was fully grown, Odysseus went away to the war, which lasted for ten years. And still a long time passed, and Odysseus had many wanderings before he came again to Ithaca. And when he returned, being worn and travel-stained, there was no one who knew him again.

But when he came to the palace, there lay at the gate the ancient hound, Argus, very near death. Yet when the hound looked upon Odysseus, and heard his voice, he lifted his head and feebly wagged his tail. But more than that he could not do, for death came upon him there in the hour of his joy at the sight of his old master, whom none but he, the faithful companion, had recognized.

THE STORY THAT HAD NO END

THERE was a certain king who, like many other kings, was very fond of hearing stories told. To this amusement he gave up all his time; but yet he was never satisfied. All the exertions of his courtiers were in vain. The more he heard, the more he wanted to hear. At last he made a proclamation, that if any man would tell him a story that lasted for ever, he would make him his heir, and give him the princess, his daughter, in marriage; but if anyone should pretend that he could tell such a story, and should fail—that is, if the story did come to an end—he was to have his head chopped off.

For such a rich prize as a beautiful princess and a kingdom, many candidates appeared; and dreadfully long were the stories that some of them told. Some lasted a week, some a month, some six months: poor fellows, they all spun them out as long as they possibly could, we may be sure; but all in vain; sooner or later they all came to an end; and, one after another, the unlucky story-tellers had their heads chopped off.

At last a man came who said that he had a story which would last for ever, if his Majesty would be pleased to give him a trial.

He was warned of his danger. He was told how many others had tried, and lost their heads; but he said he was not afraid, and so he was brought before the king. He was a man of a very composed and deliberate manner of speaking; and, after making all requisite stipulations for time for his eating, drinking, and sleeping, he thus began his story:

"O king, there was once a king who was a great tyrant; and, desiring to increase his riches, he seized upon all the corn and grain in his kingdom, and put it into an immense granary, as high as a mountain, which he built on purpose.

"This he did for several years, till the granary was nearly filled to the top. He then stopped up doors and windows, and closed it up on all sides.

"But the bricklayers had, by accident, left a very small hole near the top of the granary. Then there came a flight of locusts, and they tried to get at the corn; but the hole was so small that only one locust could pass through it at a time. So one locust went in and carried off one grain of corn; and then another locust went in and carried off another grain of corn; and then another locust went in and carried off another grain of corn; and then another locust went in and carried off another grain of corn; and then another locust went in and carried off another grain of corn; and then another locust went in and carried off another grain of corn——"

He had gone on thus from morning to night, except while he was engaged at his meals, for about a month. Then the king, though a very patient king, began to grow tired of the locusts, and interrupted his story with:

"Well, well, we have had enough of the locusts; we will suppose that they have had all the corn they wanted; tell us what happened afterwards."

The story-teller answered, very deliberately: "If it please your Majesty, it is impossible to tell you what happened afterwards before I have told you what happened first."

The king listened with admirable patience six months more, when he again interrupted him: "O friend, I am weary of your locusts! How soon do you think they will finish?"

To which the story-teller replied: "O king, who can tell? At the time to which my story has come, the locusts have cleared away a small space, it may be a cubit each way round the inside of the hole, and the air is still dark with locusts on all sides; but let the king have patience, and no doubt we shall come to the end of them in time."

Thus encouraged, the king listened on for another full year, the story-teller still going on as before.

At last the poor king could bear it no longer, and cried out:

"O man, that is enough! Take my daughter, take my kingdom, take anything—take everything, only let us hear no more of those abominable locusts."

And so the story-teller was married to the king's daughter, and was declared heir to the throne; and nobody ever expressed a wish to hear the rest of his story, for he said it was impossible to come to the other part of it till he had finished with the locusts. Thus the folly of the foolish king was stopped by the ingenious device of a very wise man.

KING OF THE GOLDEN MOUNTAIN

A VERY long time ago there lived a rich merchant who had two little children, a boy and a girl. All his riches were in two big vessels on the sea, and he was expecting them home. But one day he was told that both ships were lost, so he had nothing left but a little field.

One day he was feeling very sad, and was walking in his field, when suddenly a very ugly dwarf stood before him and said: "Why do you look so sad?"

The merchant replied: "I have lost all my money, and all I have left is this little field."

Then the dwarf said: "Don't worry any longer. If you will bring me in twelve years from now, the first thing you meet on the way home, I will give you as much gold as you like."

"Very well," said the merchant, thinking that his dog would probably meet him on his way home, "I will do as you ask." But, to his great sorrow, his little boy ran to meet him.

A month passed, and the merchant thought to himself: "I have not got any gold yet; the dwarf must have been joking with me." But one day he went up to an old attic to get some iron he thought he might sell, and there on the floor was a great heap of gold. He was delighted to become rich again.

The years went by, and his little son grew up to be a young man; and then the father, remembering his agreement with the dwarf, grew very sad, and told his son that he had promised to give him to an ugly dwarf. But his son comforted him, and said: "Father, never fear because of your promise; I will not let the dwarf take me away from you."

So when the time came they went to the little field to meet the dwarf, and the son drew a round ring on the ground and stood inside of it with his father. The dwarf soon came, and said to the merchant: "Have you brought me what you promised?"

But the old man did not answer, and his son said: "What do you want here?"

The dwarf answered: "I did not come to talk to you, but to your father, and I *will* have what he promised me."

Then they quarreled for a long time, and at last it was decided that the merchant should put his son into a little boat all by himself on a large lake that was near. He thought that his son would be drowned, so he went home feeling very sad. But the little boat went on and on, and at last stopped outside of a beautiful castle, which was quite empty, for it was enchanted. The young man jumped out of the boat, and went through all the rooms in the castle until he came to one with a white snake in it.

Now the white snake was really an enchanted princess, and she was delighted to see him, and said: "You have come at last to save me. I have been waiting for you for twelve years. You must do exactly what I tell you. To-night twelve black men will come with chains hanging all round them. They will ask you why you are here, but you must not answer, even if they beat and hurt you. The second night twelve others will come, and the third night twenty-four more will come and cut off your head; but at twelve o'clock on the third night their power is gone, and I shall be free, and will come to you, and will wash you with the water of life to make you live again."

All these things happened just as the princess had told him, and the third night the white snake changed into a beautiful princess and married the merchant's son, and he became the King of the Golden Mountain.

They lived a long time together, and were very happy, and the queen had a little son. One day the king thought of his poor father, and he longed to go and see him again. But the queen did not want him to go, and said: "If you go, I know that something dreadful will happen." But he would not listen to her pleadings. So the queen gave him a wishing-ring, saying: "Put this on your finger, and it will bring you whatever you wish for; but you must promise not to wish that I may be with you when you are at your father's house."

The king promised to do as she asked, and, turning the ring on his finger, wished to be near the town where his father lived. But the soldiers who guarded the city would not let him enter it, because his clothes were so different from theirs. So he borrowed an old shepherd's frock, and went to his father's house. But his father did not recognize his own son, and said:

"You are certainly not my son, for he died a very long time ago."

Then the King of the Golden Mountain replied: "I am really your son. Is there no mark by which you can tell that I am your son?"

"Yes," said his mother; "our son has a mark like a raspberry under his right arm."

THE DWARFS ILL-TREATED AND TORTURED HIM, BUT HE REMAINED SILENT

Then he showed them this mark, and they were convinced that he was their son. He then told them all his adventures, how he was a king, and was married to a beautiful princess, and had a little boy seven years old.

But the merchant said: "You cannot be telling the truth. What king would travel about in an old shepherd's frock?"

Then the king was very angry, and wished that the queen and his little boy were with him, and they instantly stood before him. The queen was very sorrowful, and said that he had broken his promise, and that ill-luck would come to them.

One day the king and queen went for a walk together, and the king showed her the place where he was put into the little boat. Then, feeling very tired, they sat down, and he went to sleep. The queen, wishing to punish him for having broken his promise, took the wishing-ring off his finger, and wished herself and her son back at the castle. When the king awoke he found himself alone, and saw that the ring had gone from his finger. He said to himself: "I can never go back to my father's house; they would say that I was a sorcerer. I will go a long journey to discover the whereabouts of my kingdom."

So he started off, and walked on till he came to a mountain where three giants were quarreling over their inheritance. When they saw him pass they said to each other: "Little men have sharp wits; he shall divide the inheritance between us."

This inheritance was a sword which could cut off anybody's head when the wearer said "Heads off!" a cloak that made the owner invisible, or gave him any form he pleased; and a magic pair of boots that took the person who put them on to wherever he wished to go.

The king said to the giants: "I must try these wonderful things first; then I shall be able to decide for you."

Then they gave him the cloak, and he wished himself a fly, and he immediately became a fly.

"The cloak is all right," he said; "now give me the sword."

"No," said they, "not unless you promise not to say 'Heads off!' If you do, we shall all become dead men."

So the king tried its magic power on a tree standing near by.

Then he said: "Give me the boots to try, too." And as soon as the clever king got all three he wished himself back at the Golden Mountain, and immediately he was there. As the king came near his castle he heard merry music, and the people round about told him that his queen was about to marry another prince. When the king heard this he was very angry, and putting his cloak around him, he went to the castle. A great feast was being held, and the king sat unseen beside the queen, and when anything was given her to eat and drink he took it away from her. When the queen saw this she was much frightened, and went away to her own room, the king following her.

"Alas!" she said to herself, "I am still in the power of some enchantment."

Then the king took off the cloak, and said: "I did save you, but you deceived me. Have I deserved this bad treatment from you?"

Then he went out and told all the merry-makers to go, and said the wedding would not take place, as he was the right king. Then the princes and nobles laughed at him, and tried to seize him; but the king drew his magic sword and cut off all their heads.

So he became once more King of the Golden Mountain, and lived happily with his queen and son ever after.

NAPOLEON'S WONDERFUL ESCAPE

It is interesting to know the story of Napoleon's wonderful escape, at the time when the Royalists were plotting against his life. They planned to kill him by means of the infernal machine, or *machine infernale*, as the French called it. It consisted of a barrel of gunpowder, and it was placed on a cart, to which it was strongly bound by cords, with grape-shot piled round about it, and with a slow-match attached to the powder. The conspirators were Bourbons, who wished to get Napoleon out of the way, so that the monarchy might be restored. The night of the outrage was December 24, 1800.

On this night Napoleon was going to the opera. The conspirators wheeled their carriage, which had been prepared by a Breton peasant named Georges Cadoudal, into the Rue Saint Nicaise, and waited for the procession to go by. At the right moment the match was ignited, and some of the conspirators actually stood by to watch the havoc of the explosion. The match burned a trifle slower than these monsters had imagined. The carriage containing Napoleon passed the loaded cart. But hardly had it gone by when a terrific explosion took place. The street was immediately plunged into darkness. The crash of shivered glass and rolling stone mingled with cries of agony and terror. Twenty people were struck dead. Fifty-three, including the conspirator who had lighted the match, were horribly wounded. The whole neighborhood was thrown into the most frightful panic imaginable.

Out of the quiet night, in the centre of happy Paris, and far from scenes of war and death, there had suddenly leaped this terrible thing of slaughter and destruction, scattering agony and death among innocent women and children, and filling the minds of people with the madness of terror. That is the reason why the French gave to this wicked invention the name of *machine infernale*, or infernal machine. Napoleon escaped without injury; but never was he in greater peril.

THE FABLES OF THE BUDDHA

There was once a King of Persia who read that on the mountains of India grew a tree which gave a medicine that brought the dead to life. The king sent his chief physician to India to get some of this medicine, and the physician met a wise man, who said: "Your king did not understand the book. By the mountains of India are meant the greatest of her wise men. The Tree of Life is the wisdom that grows from their minds, and their writings are the medicine which brings the dead to life." Then the wise man gave the physician a book of fables. This book of fables has been translated into many languages. Some of its tales were composed by the Buddha, the great religious teacher, whose life is related on page 3023, and others were collected by Buddhist monks, about 2,300 years ago. Here are some of the stories.

THE STRONGEST THING

AN Indian magician was walking one evening by the bank of the Ganges, when an owl flew by, carrying in its beak a little mouse.

Being frightened, it dropped the mouse, and the Magician, who was a kind-hearted man, took the little creature home, and healed it, and changed it into a very beautiful girl.

"Now, my dear," he said, "I must find you a husband. Whom would you like to marry? I am a great magician, able to perform wonderful things, and I can carry out your slightest wish."

The adopted daughter of the Magician seemed pleased; her eyes twinkled.

"I should like to marry the most powerful being in the universe," she said.

"There is nothing in the universe more powerful than the Sun," said the Magician. "I will marry you to him." So he asked the Sun to marry her.

THE MAGICIAN CHANGED HER TO A MOUSE

"I am not the most powerful being," said the Sun. "Look at the great Cloud that covers me and hides my light. He is far greater and stronger than I."

"Well, you must marry my adopted daughter," said the Magician to the Cloud.

"There's somebody stronger than I," said the Cloud. "The Wind tosses me about just as he pleases."

But the Magician found that the Wind was not as powerful as the Mountain which towered, terrace upon terrace, right up into the sky, and stopped the fiercest tempest.

"And there's somebody stronger than I," said the Mountain. "Look at the Mouse which bores holes in my side, and lives there whether I like it or not. All my strength will not frighten him away."

The Magician was grieved at the result of his inquiries. He felt sure that his adopted daughter would never stoop so low as to wed a mouse. To his great surprise, however, she was delighted to hear that the Mouse was the strongest creature in the world. So the Magician changed her back into a mouse, the shape in which he had found her, and the two were very happily married.

You can alter anyone's appearance, but that does not alter his nature.

THE WISE AND FOOLISH FAIRIES

WHEN the Fairies of the Trees set out to choose their dwelling-places, some were wise and some were foolish.

The wise fairies shunned the trees that stood alone in the open fields, and settled in a thick forest.

But the foolish fairies said: "Why should we crowd together in a forest? Let us go and live in lonely trees near villages, where men will bring us gifts."

But one night a great tempest swept over the country. The lonely trees were blown down, and the foolish fairies became homeless. But the great, dense forest resisted the fury of the storm, and none of the trees there was injured. And the wise fairies said to the foolish fairies:

THE FOOLISH FAIRIES BECAME HOMELESS

"People should stand united like a forest. It is only the solitary tree growing unprotected upon the bleak hills or in the open fields that is overthrown or broken by a storm."

Union is strength.

THE CRANE AND THE WISE CRAB

A CRANE grew too old and feeble to catch the fish that lived in a lake close to his nest. So he resolved to do by cunning what he could no longer do by force. And he said to a crab in the lake:

"My dear friend, what will you and all the fishes do now? Some men are coming presently to drain every drop of water out of the lake. You'll all be caught and killed!"

On hearing this dreadful news, all the fishes assembled to try to find some way of escape.

"I have thought of a plan," said the cunning old Crane. "Of course, I eat one or two of you now and then; but I don't want you to perish in a heap for want of water. What good would that do to me? Now, there is a large pond just a few hundred yards away. Let me carry you, one by one, in my beak to this safe place."

The fishes got an old carp to go with the Crane to see if there was such a pond. The Crane took him very gently in his beak and showed him the new stretch of water, and then put him back among his companions, and when the fishes heard about the pond they cried:

"Very well, Mr. Crane; you can take us all with you!"

The cunning old Crane meant to take the fishes one by one in his beak, and eat them under a tree far away from the pond; but, unhappily for him, he began with the wise Crab.

"Come along," he said to the Crab, "and let me take you in my beak to the new pond."

"I don't like to trust myself in your beak," said the Crab. "You might let me fall and break my shell. We crabs have a famous grip. Let me catch hold of you round the neck, and then you can take me."

The Crane did not see that the Crab was trying to outwit him, and agreed to the proposal. But when the Crab was fixed on his neck, instead of going to the pond, he went to the tree.

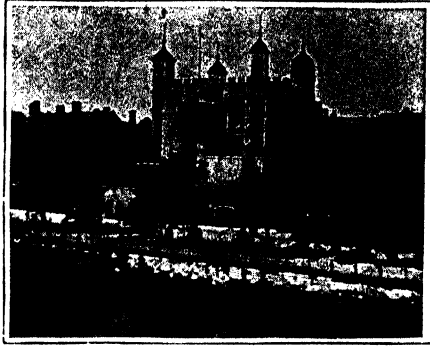
"Where is the pond?" said the Crab.

"Pond?" said the wicked old Crane. "Do you think I'm taking all this trouble for nothing? The whole thing is just a trick for catching you and the other fishes, one by one, and eating you."

HE DROVE HIS CLAWS INTO THE CRANE'S NECK

"Just what I thought," said the Crab. And he drove his claws into the neck of the wicked old Crane, and killed him.

The wicked and the cunning are always caught in their own traps.

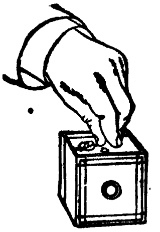


USING THE CAMERA OUTDOORS

CONTINUED FROM 4202

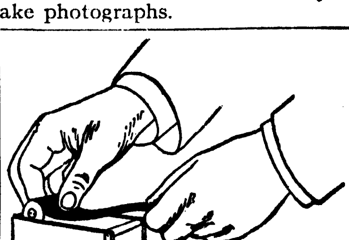
PHOTOGRAPHY is one of the most interesting of all hobbies, for it enables us to keep a pictorial record, that is, a record in pictures, of the places we visit during the holidays, and of anything that happens to us, or to those around us.

Most cameras made nowadays can be loaded in daylight. This does away with the necessity of going to a dark-room every time we want to put in a new roll of films. In loading a box-camera, place it upon a table, and unlock it by turning the nickel catch to the right, as shown in figure 1. This releases the winding key, and allows the door at the back to be opened. Place the cartridge in the clip on the right side of the holder, as shown in figure 2. Now pass the black paper across the opening and in front of the flap, and insert the end of the paper through the slit in the empty reel, as shown in figure 3. Place the spool in position, close the camera, and turn the key until the number 1 appears at the little red window. It is now ready for us to take photographs.

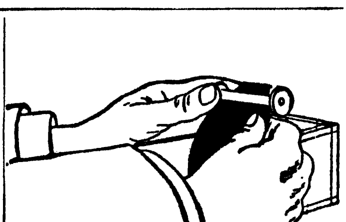


1. Unlocking the camera.

If we wish to take outdoor pictures, we must observe certain principles in order to have good results. In landscape photography, we must have one main object in the picture that exceeds all others in interest. For example, a bit of cloud, a vessel, a single tree, or some one object that attracts the eye will add to the interest of the view. A second principle we must remember is not to divide the picture exactly in the middle by the horizon line. Try to give a larger portion of the picture either to the sky or to the land. It is well to have a roadway or path in the scene to direct the eye from the foreground gradually to the distance. A stream of water catching glimpses of light or reflection of trees, will serve the same purpose of leading the eye into the picture.



2. Inserting the film into the camera.



3. Fixing the black paper in position.

Remember that a camera does not see pictures in color as we do, but it sees everything in black and white, or masses of light and shade. It is the light shining upon things and creating shadows that makes the photograph for us. We must not point the camera toward the sun if we wish to get a good picture. If the sun is shining directly into the camera, protect the lens at the moment of exposure by holding your hand or a piece of cardboard above the top of the lens or a little to one side to screen it.

Remember to hold your camera motionless and also level, since tipping it in any way gives distorted views. If the camera is tipped up, the vertical lines in the picture will seem to come together at the top; and if the camera is tipped down, the lines will seem to meet near the bottom.

HOW TO TREAT BROKEN BONES

A THIRD LESSON IN FIRST AID TO THE INJURED

CONTINUED FROM PAGE 4201.

PERHAPS the most common form of accident in which the rendering of first aid to the injured person is necessary is that in which some bone of the body is broken. This breaking of a bone is called a fracture, and fracture comes from a Latin word meaning to break. A fracture may occur by what is called direct violence, as when a blow is given or a wagon wheel runs over a foot. In these cases the bone breaks at a place where the force is applied. A fracture may also occur by indirect violence, as when a boy falls on his hands and breaks a collarbone, or when a man falls on his feet and fractures his skull.

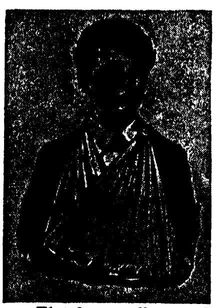
Bandage and sling for a broken humerus.

Now, all the people who are so unfortunate as to break a bone do not do so in the same way, and different names are given to the different kinds of fractures.

A simple fracture is where the bone is broken once, and there is little or no injury to the soft parts of the body near the bone.

A compound fracture is where, in addition to the broken bone, there is a wound leading from the outside of the body to the bone, thus enabling germs in the air to reach the broken bone. Sometimes the wound is caused by the sharp end of the broken bone sticking through the flesh, and at other times it may be inflicted from outside by the implement that broke the bone, as when a bullet breaks a bone.

A complicated fracture is when there is not only a broken bone, but an injury to one of the organs of the body, as to a lung, or to the brain, or to an important blood-vessel. A multiple, or comminuted, fracture is the breaking of the bone in more places than one, and, of course, this kind of fracture may also be compound. Comminuted is derived from a Latin word that means crushed or powdered.



The large sling.

An impacted fracture is one in which the two ends of broken bone are forced into one another. A greenstick fracture takes place when a young child meets with an accident that would result in a broken bone to an older person. The child's bone, being soft, acts very much like a green branch, because, instead of breaking right across, it bends and cracks only.

In this lesson we are going to learn what to do in the case of broken arms and legs, but first of all we must learn to know when bones are broken. There are some methods of knowing that a bone is broken which must be used only by a qualified doctor; but there are five different tests that we who are going to render first aid may apply without any risk, and by some or all of these we can tell beyond doubt when a fracture has occurred.

First of all, there is usually pain at the place where the bone is broken. Then there is what doctors call inability—that is, loss of power in the limb below the place where the bone is broken. The part where the fracture occurs will usually be swollen, and it is important that we should not think a person is less seriously injured than he really is because, owing to the swelling, we cannot see some of the other signs of a fracture. If there is the slightest doubt as to the nature of an injury, it is by far the best to treat it as a fracture. The part where a bone is broken often becomes deformed—that is to say, has an unnatural position or appearance. A broken leg, for instance, may sometimes appear shorter than it should be. When the broken bone is quite near to the skin, by drawing the hand gently along the surface of the place we can often feel and locate the break. Of course, if the fracture is a compound one the bone can be seen.

The most important thing to remember in a case of fracture is that the patient must on no account be lifted off the ground to be placed on a stretcher or in a cab until some kind of splint or support has been found and tied to the broken limb to keep it in one position.

For first aid, proper medical splints are not often available, and so we have to make use of anything that is ready to hand, and it is most surprising how many things can be utilized for splints. Among other things that are useful are umbrellas, walking-sticks, baseball bats, rifles, flag-sticks, pitchforks, fireirons, boards, fence-posts, boughs of trees, bundles of twigs, bundles of firewood, pieces of stout cardboard, newspapers folded up, billiard-cues, rolled-up maps or any pictures that have a wooden roller, tools such as chisels, hammers, saws, and screwdrivers. The chief thing that is needed in a splint is that the article used should be long enough and firm enough to keep the parts of the limb above and below the fracture perfectly free from the slightest movement. Splints of all kinds should be padded with clothing.

Splints are tied to the broken limb with bandages, and the regular triangular bandages are the best; but if these are not to be had we may use neckties, scarves, belts, strips of toweling or sacking, or, indeed, anything that can be transformed rapidly into a bandage. The bandages adjusting the splint should be placed twice round the

limb and splint, if possible, before tying, and they should always be tied firmly, though not tightly.

When regular triangular bandages are used, they should be folded narrow when they are wanted for the arm or forearm, and narrow or medium when to be used for the thigh or leg. When tying the splint in position, the bandages above the fracture should be put on first, in order to keep the splint firm. Of course, should there be bleeding from the wound, this must be carefully attended to before the splints are put on; but we shall learn how to stop bleeding in a later lesson.

A broken forearm bandaged.

After a fracture has been attended to, the patient must be covered with coats or other garments to keep him warm, even though the weather be not cold.

Now we shall learn how to treat different fractures of the arm or leg. When the humerus is broken, we make three or four short splints reaching from the shoulder to the elbow, securing them in position with bandages as shown in the first picture. The first splint must not be so long that it will press on the blood-vessels at the elbow-joint. The forearm must then be supported in a small sling. There are two kinds of arm-slings—the large and the small—both made from a triangular bandage. For a large sling we open out the bandage, place one end over the shoulder on the uninjured side, and, bringing it round the neck, tie it with a reef knot to the other end as shown in the second picture. The loose point is brought in front of the injured arm and pinned with two pins. For a small arm-sling we use the triangular bandage folded broad, and tie it round the neck in the same way as a large bandage.

Bandage for broken fingers.

When the forearm of an injured limb is placed in a sling, the hand should always be slightly higher than the elbow. Of course, where no proper bandages are available, anything may be used for a sling. When there is a fracture of one or both bones of the forearm, take two well-padded splints reaching from the elbow to the finger-tips, put one inside near the body and one outside, and bandage them to the arm, using three bandages, one above and one below the fracture, and one round the hand, as shown in the third picture. Then support the forearm in a large arm-sling. For a fracture of the hand or fingers, put a padded splint to the front of the hand from beyond the finger-tips to above the wrist, bandage with a narrow bandage as shown in the fourth picture, and support in a large arm-sling. It is important that a fracture of the arm, or wrist, should be properly treated from the first, otherwise it may never regain its full strength and use.

A broom used as a splint for a broken thigh-bone.

Fractures of the elbow-joint are serious and must not be left longer than absolutely necessary, as they require proper medical attention. We should in such cases simply rest the arm upon a pillow in the most comfortable position, and summon a doctor as quickly as possible.

A fractured thigh-bone is a most serious injury, and must have careful attention. We must place the patient on his back. Then someone must hold the ankle and foot, and very gently pull the foot down until it is quite level with the other foot. Then, while the foot is held in position, a long splint reaching the entire length from the foot to the armpit must be placed on the outside of the injured leg, and a shorter splint inside, and the whole bandaged carefully together as in the fifth picture. One bandage goes round the body below the armpits, the next round the hips, the next just above the fracture, the next just below the fracture, the next lower down the leg, and the next round the ankles, to be tied beneath the feet. Still another bandage is tied round the knee. The inner splint is often dispensed with, and the two legs are tied together, the sound leg supporting the injured one.

When the kneecap is fractured, the patient should lie on his back with his shoulders and head raised up. The leg should be straightened, and the foot raised and rested on a cushion, block of wood, heap of clothing, or anything of that kind that is immediately available. A long, flat splint is placed at the back of the leg and tied just above and below the injured kneecap, at the thigh, and just above the feet. It is most essential that the foot be kept raised off the ground until the doctor arrives.

A broken foot bandaged.

For a fracture of either or both of the lower leg-bones, the treatment is as in the case of a fractured thigh, with the exception that the splints are kept in position by bandages tied immediately above and below the fracture, just above the knee, round both ankles, and round both knees.

For a crushed or fractured foot, remove the shoe by slitting the back seam and undoing the laces, place a padded splint to the sole of the foot from toe to heel, and bandage like a figure eight, as shown in the sixth picture.

Always remember in tying the bandages that, no matter where the fracture may be, or what kind of fracture it is, the bandage must be tied firmly, but not so tightly that it will interfere in any way with the circulation of the blood. That would be very harmful for the patient, and if persisted in might cause a very painful sore. A bandaged hand should be slightly raised in order that the finger-tips may be at a higher level than the elbow.

CONTINUED ON PAGE 4382.

MAKING A COLLECTION OF ROCKS

WE read all about the crust of the earth upon which we live on page 2919 of this book and on the pages that follow, and it will be a recreation that is both entertaining and instructive to form a collection of rocks and fossils. These will provide literally "sermons in stones," for every stone, dumb as it may seem, has a story to tell and a lesson to teach.

WHAT THE COLLECTION SHOULD CONTAIN

In making a collection of stones and rocks, we should aim to have every layer of the earth's crust represented. There should be specimens of the rocks formed by the action of fire, rocks formed of material deposited by water, pieces of those parts of the earth's crust formed by layers of vegetable matter, like the coal measures; and then we should have as many varieties as possible of fossils—that is, creatures that lived in a bygone age and have been turned into stone and thus preserved. Then, wherever we keep our collection of stones, we should always try to keep them in their right order—that is, according to the age when formed, or, what usually means the same thing, the depth at which they were found.

WHERE TO OBTAIN SPECIMENS

Specimens of many rocks are not difficult to obtain. We may find many specimens lying about on the seashore when we are away on a holiday—and it is astonishing what a variety of rocks may be got together in this way in the course of a few years—granites, limestones, sandstones, serpentine, quartz, madrepore, or coral, and so on.

Then we may sometimes find a specimen we are wanting in one of the roads of our cities or towns. Some years ago a boy who belonged to a geology class saw in a macadamized road that had recently been relaid with stones, though not yet gone over with the steam-roller, a piece of interesting rock called mica-schist. Stooping to pick this up, he found by its side another rock called gneiss, and then a fossil, half embedded in rock. This aroused his interest, and he picked up another and another until all his pockets were full.

Having shown his fellow-students the fine geological collection that he had secured in this unusual and unexpected way, it was not long before thirty or forty boys were wandering up and down the road picking up stones here and there, and filling their pockets. This went on for several days, until at last a policeman was stationed at the place to guard the road. Probably it was the first time that the guardian of the law had had to protect the road itself from being carried away. Of course, the wholesale removal of a macadamized road is not recommended, but by keeping our eyes open, even in the streets of our towns, we may often come across a specimen well worth adding to our collection.

TOOLS FOR OBTAINING MINERALS

Naturally, the specimens that teach us most, and that will in after years be of most interest to us, are those that we actually chip out of their rocky bed in some quarry or cutting. For this purpose we need quite inexpensive tools—simply a good steel hammer and a strong chisel of good quality. In selecting the hammer, we should see that the head is broad and thick at one end, and that the other end is wedge-shaped. A hammer of this kind is quite indispensable to the geologist, and it will be found to serve its purpose far better than a hammer of any other shape.

When we secure a specimen, we should chip it into a convenient size and shape and wrap it up in a piece of paper, upon which we should write the place in which it was found and the date when found.

There are many places in which we may chip out our own specimens—railway-cuttings, road-cuttings, quarries, mining works, brick-pits, and so on; and the workmen at these places will be found to be generally very civil, and willing to assist us in securing specimens. If we are living or staying near any of these works, we can often induce a laborer to save us anything interesting that he comes across in the way of fossils, and we can learn from the men where fossils are most likely to be found in the district.

HOW TO KEEP THE SPECIMENS

On arriving home after an expedition, we should sort out our newly obtained specimens, write a neat little label for each, bearing the name of the place where it was found, the name of the rock, and, if we know it, the geological name of the formation, or the layer of rocks, from which it came, and paste each label upon the specimen to which it belongs.

To serve as cases for our rocks and fossils, if we have no proper cabinet at home, we can obtain flat wooden boxes for a few cents from the grocer or druggist, or make flat trays with rough compartments to hold the specimens, which as a rule should not be larger than a big walnut.

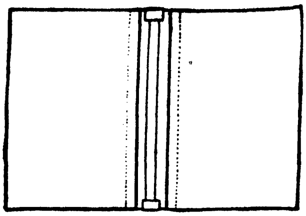
No region in the world will afford a more varied collection of minerals or of fossils than North America, especially if the collector happens to live among the mountainous parts in New England, or along the Alleghanies; the whole country is a sort of geological museum, for the strata or layers of rock in the crust of the earth have been so broken and heaved, and then so ground down on the crests of the ridges, that the edges of almost the whole series of strata are sometimes exposed to view. This is still more true of the Rocky Mountain region, where thick masses of strata stand almost upright against the mountains which have been thrust up through them like wedges. Then, too, the rivers have cut deep trenches through the strata in some places, so that you can see just how they lie, and of what they are composed.

But it is also possible to collect many varieties of minerals and rocks even in the prairie country, by studying the pebbles and boulders which have been left there by the ice of the Glacial Period—a matter you will need and want to read about the moment you become interested in your subject.

HOW TO MAKE A DAINTY BLOTTER

A DURABLE and neat blotter which will hold notepaper and envelopes, and has a cover that can be taken off, washed, and put on again, is a useful thing to possess. The one described here is easy to make, and quite inexpensive.

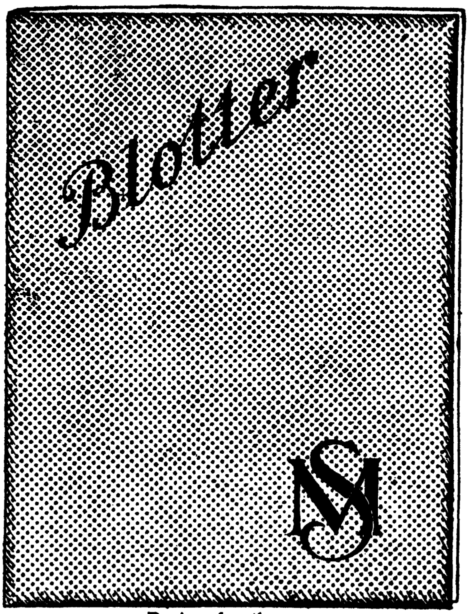
The materials required are two pieces of stiff cardboard to form the two halves of the cover, a strip of calico to bind them together, some crash or colored linen to cover the cardboard, a fine cord to sew round the edge of the cover, and a skein of embroidery floss or mercerized cotton, costing 5c., for working initials or a pretty design on the cover.



1. The foundation.

A crash material, thirty-six inches wide and costing 25c. a yard, is frequently used for making blotters, because it is substantial, washes well, and, being of a canvas texture, may be readily embroidered. A suitable cotton cord costs very little, and a silk one can be got at 5c. a yard.

The blotter can, of course, be made any size we prefer. For a large one measuring twelve inches by nine, half a yard of crash would be ample. The two cards—a good white cardboard is best—should be cut quite within these measurements, and should be exactly the same size, with smooth, neat edges. The strip of calico should be about one and a quarter inches wide and longer than the card covers. These are placed side by side face downwards, about three-eighths of an inch apart, and the strip of calico is then stuck on the adjoining edges with liquid glue or a strong gum. Care must be taken not to let the pieces of card touch, for if they do so the blotter will not open and shut easily. The ends of the calico are doubled over and stuck on neatly, as we can see in the first picture.



2. Design for the cover.

When the card foundation is made it is put aside to dry, and while it is drying we can set about cutting out the material for the cover.

If the material permits, the outside and the two pockets for the inside may be cut all in one long strip of thirty-six inches, just the width of the crash material, eighteen inches forming the back and front, and nine inches each for the inner pockets. The picture shows how the pockets inside are made. A broad hem prevents their openings from fraying, and their sides are run up on the wrong side. Before running them up, it is advisable to test the fit of the cardboard foundation which is to be slipped into them. And if we intend to embroider the front cover in any way, now is the time to do it, as it is so much easier to handle it before the pockets are sewn.

Picture 2 shows a design for the cover outlined in deep pink embroidery floss. If we cannot draw the monogram, we can buy little model card letters at two cents each and work these on to the material with satin stitch. A pattern can be transferred in the way described on page 1517.

Having made the pockets, we next stitch the cord round the edge of the cover, choosing for its color a pretty pink or perhaps a blue to match the embroidery on the outside. Before placing the card foundation in the cover, we must cut out three sheets of blotting-paper, fold them to the size of the blotter, and stitch them on to the calico strip in the same way that pages of an exercise-book are stitched on to the cover.

Now we can slip the two cards into the two pockets of the cover, and our blotter is ready for use. If we are thinking of giving our blotter as a present to a relation or friend, we could, of course, make it look prettier and daintier by working a more elaborate design, or, better still, quite charming covers could be made of brocade or thick corded old rose or green silk, although this works out a little more expensive.

Should there be enough material left, a good idea would be to make a cover in exactly the same way for a telephone book or a time-table. The paper covers are slipped into the pockets, and a fine cord is passed round the back of the cover and half-way through the book to keep it securely in the cover. A suitable design for this would be a railway signal-post and arm bearing the title of the book, or we might have the name Telephone Directory worked in a contrasting color up the back of the cover, or slantwise on the front.

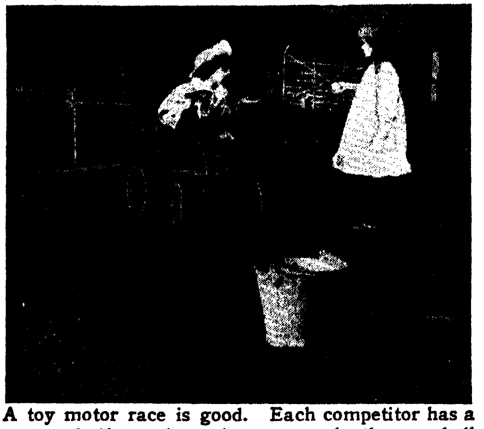
The best plan is either to write the letters ourselves in pencil, or to get someone who writes a nice flowing hand to do so for us, and then embroider over the pencil. If printing is one of our good points, we may prefer to print the letters, or we may even use a stencil pattern.

GAMES FOR A CHILDREN'S GARDEN PARTY

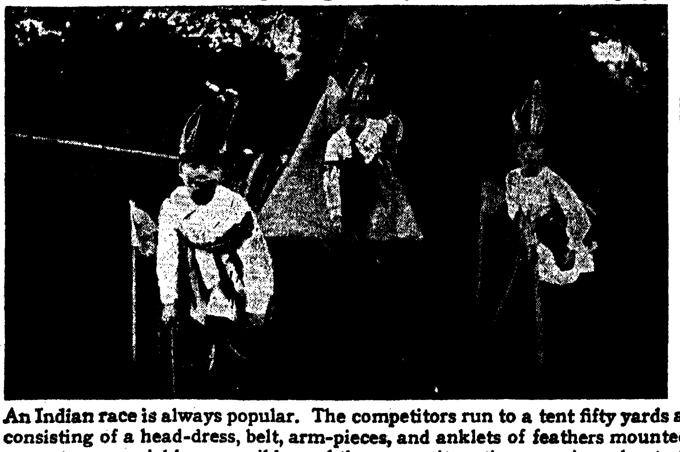
Of the many games that can be played at a garden party, none is more amusing than balloon-breaking on "horseback." Each player must get a grown-up friend to act as horse, and must be armed with a long, pointed stick to use as a lance.

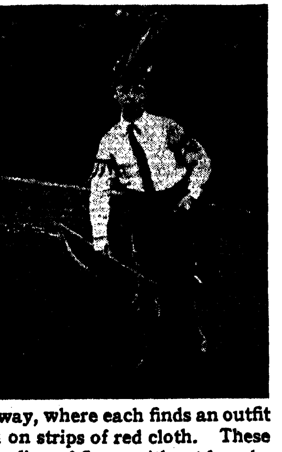
In the game of balloon-breaking the player wins who, with his stick, breaks the balloon, which is fastened to a piece of string. A player on foot runs round with the balloon, jerking it about to prevent it from getting broken, and the fun depends on his skill.

A human wheelbarrow race is always exciting, for there are generally some spills that cause much laughter. The course should be not more than thirty yards long, and we see here the correct way to stand at the start. As soon as the signal is given they start.



A toy motor race is good. Each competitor has a partner half-way down the course, who throws a ball as the cyclist comes up. The cyclist catches this, cycles to the end, drops the ball in a bucket, and returns. The player who first returns is the winner.





An Indian race is always popular. The competitors run to a tent fifty yards away, where each finds an outfit consisting of a head-dress, belt, arm-pieces, and anklets of feathers mounted on strips of red cloth. These are put on as quickly as possible, and the competitors then race in and out of a line of flags, without knocking any down, and thence to the winning-post, fifty yards farther on. The left-hand picture shows the competitors as they leave the tent, and on the right we see the winner of the race arriving home.

A CHILDREN'S ENCYCLOPÆDIA PARTY

WITH A PROGRAMME OF GARDEN PLAY MADE UP FROM THIS BOOK

IT sometimes happens that, when a boy or girl asks permission to give a party, the answer is: "Certainly—if you can manage it yourself, and won't expect me to amuse your guests." With a little forethought and arrangement any boy can give a most successful party if—and this is a most important thing to remember—if he carefully plans out every minute of the afternoon, and leaves nothing to chance. You will find fully described in THE BOOK OF KNOWLEDGE, all the games and tricks which are suggested in the programme given below. Still other games may be found by looking in the Index.

WHAT TO DO AND HOW TO DO IT: A LITTLE PROGRAMME OF EVENTS

TIME	GAME
3.0	STICKERCHIEF
3.20	MEASURING THE HEIGHT OF A TREE
3.30	WHAT CAN BE MADE FROM POTATOES AND CUCUMBERS
4.0	A SACK RACE
4.20	TEA
5.0	CONJURING TRICKS
	A BALL THAT ANSWERS QUESTIONS
	MAGIC SCISSORS
	CUTTING THE MAGIC STRING
	THE MAGICIAN'S JACKET
5.30	HOW MARY GOT THE EGGS
	The problem can be set on the lawn with a rug and planks
6.0	SEMAPHORING
6.30	TUG-OF-WAR
6.45	HOT-AIR BALLOONING

This gives a very good afternoon's entertainment, and will sustain the merriment from the very beginning to the end. Other suggestions for a children's garden party will be found on page 4292. Inexpensive prizes of sweets or toys may be given to the winners.

THE WAY TO IDENTIFY A SELECTED CARD

TO identify a selected card without ever touching the pack of cards is sure to mystify and impress an audience.

We take a pack of cards and ask one of the audience to hold it. Then we ask another member of the audience to select a card from anywhere in the pack, to look at it so that he can recognize it again, and to show it to the audience but not to us. Then we ask the friend who selected the card to place it at the bottom of the pack. The holder of the entire pack is then requested to lay the pack on the table face downwards.

We must invite a third friend to assist us. His part of the performance is to cut the cards, that is to say, to lift any number from the top of the pack and put them at the bottom of the pack. Finally, we ask yet another member of the audience to lay the cards face upwards on the table one by one, beginning at the top and going right through the pack. When he has done this we are able to tell the audience which was the card selected.

This looks very difficult, but it is really very simple. Before handing over the pack at the beginning, we look to see what card is at the bottom of the pack. When the cards are finally laid on the table one by one, the selected card always follows immediately after the card which we saw at the bottom.

HOW DID THE FARMER ENLARGE THE FOLD?

A FARMER had fifty hurdles, and with these he made a sheep-fold that would hold exactly a hundred sheep. Later on, as he had a good deal of fine pasture land, he decided to increase the number of his sheep, and so he went to market to buy some more of these animals. Prices were low, and, although he had intended to buy only about fifty more sheep, he changed his mind and bought a hundred. The result was that, having now double the number of sheep that he possessed originally, he would require double the accommodation in his fold. A friend who had driven to the market with him remembered this, and mentioned the matter.

"Oh," said he, "I had forgotten that; but it is easily put right. I must buy two more hurdles and then I shall have sufficient room."

"Only two more hurdles to give you double the space in your fold? You have made a mistake," said the friend.

But the farmer was quite sure he was right, and he bought only two hurdles, although his friend said that he would require more.

The next day the farmer met his friend.

"Well, I have doubled the accommodation of my sheep-fold, and found the two extra hurdles quite sufficient," said he.

The friend seemed very doubtful, so the farmer took him to the field where the fold was, and in a moment the friend saw that the farmer was right. How did he do so much with only two hurdles? The answer to this little problem will be found on page 4388.

THE RIGHT WAY TO MEND THINGS

THERE are many things in use almost every day that get broken, and are then laid aside as useless, although to repair such broken things is really an easy task, if only we knew how to set about it. A few hints will be useful to us, and enable us to mend our broken toys and books and other things and make them almost as fine in appearance as when they were new.

BROKEN TOYS

Accidents happen to toys in spite of the care taken of them; but it is a pity to put them away as useless when they can be mended and made almost as good as new. Glue, tape, string, paint, nails, and paper are some of the things we shall require.

Crumpled tin soldiers can be straightened with pincers and freshened with coats of paint; bent tin trains hammered and pressed straight; broken arms of a windmill, loose wheels of carts, legs of furniture belonging to the dolls' house, and numbers of wooden articles mended with glue. If we are at all handy, we shall have no difficulty in soldering substantial metal playthings. Any of these toys when repaired would be welcomed with open arms by the children in hospitals.

TORN MUSIC

Sheets of printed music easily tear round the edges, and a slit once started is apt to end in a page torn in halves. A good way to prevent this, and also to strengthen the margin of the sheet, is to cut a piece of very thin paper the required length and width and paste it on. If a tear occurs across the printed part, we should dip a strip of tissue-paper in white of egg and use that, as the music can be read through it. A reel of transparent adhesive paper, which answers the same purpose, may be had for a few cents. A binding of narrow ribbon will greatly strengthen the back of the damaged music.

A WORN BOOK

The covers of books that have been roughly treated or imperfectly bound often tear away, half the cover usually becoming detached first. The part torn away can be mended by gumming it up the back, strengthening it with linen, and sticking the loosened half of the cover to the first page; but, if the binding be very stiff, thin glue is a better adhesive.

A loose page can be secured by folding a strip of the adhesive paper and sticking one half of it to the loose page and the other half to the next page in the book. This can be repeated on the other side of the page.

A BROKEN SPADE AND BASEBALL BAT

When the stick portion of a wooden spade breaks in two, we should get a thin piece of wood, whalebone, or steel, and, placing the broken ends together, bind it along them like a splint, with a piece of twine wound tightly and evenly round and round. A second splint adds strength, but looks clumsy. We can tuck the ends of twine in with a penknife. If the stick breaks off at the blade, the spade cannot be mended; but, if the blade is made of iron, we may burn the wood out of the socket, point the stick, insert it, and fasten it with a nail or screw. A split bat can be mended by binding it tightly with good twine, that should be beeswaxed as it is put on. We must tuck the ends of the twine in very carefully to prevent it from working loose.

TORN BATTLEDORE AND BROKEN DRUM

If the parchment of these toys get punctured and torn, we must remove all the torn part, get a piece of parchment—good type-writer paper will do—cut it to shape, soak it in white of egg, and paste it over the frame of the battledore or drum.

A PUNCTURED CYCLE TIRE

We must partly remove the outer cover of the pneumatic tire, and take out the inner tube. After pumping a little air into the tube, we should listen to locate the puncture. If we cannot find it in this way, we may feel along the surface to discover the escaping air. If this test fails, we must put the tube in a pail of water, when bubbles will rise from the puncture.

We rub the tube with sandpaper about half an inch round the hole, apply a little rubber solution to the place and also to the india-rubber patch to go over the hole. When nearly dry, we stick the patch on, pressing the edges down firmly all round. Then we rub it over with ordinary French chalk and carefully replace the inner tube in position.

A DOLL'S BROKEN HEAD

If the china head of a doll breaks off at the neck, it can be stuck on again with seccotine or glue. Thin glue is suitable for china, wax, composition, or wood, and it must be coated along the broken edges. Doll's hair can be stuck on with the same adhesive substance.

BROKEN CHINA AND GLASS

Little ornaments which decorate the mantelpiece sometimes fall and get broken or chipped. Unless they are very badly broken, it is generally worth while mending them, and mending them is often easy.

They can be mended with thin glue, which can be squeezed out along the broken edge of the china or glass, or applied to it with a camel-hair brush. We must place the broken pieces together, and hold them so for a minute or two. The drops which ooze from the join must be wiped off at once with a rag, for thin glue dries very quickly indeed, and after it has dried it is very difficult to get it off.

BROKEN UMBRELLAS

If the handle of our umbrella breaks, we may be able to repair it with glue. If this fails, it must be replaced by a new handle. A fresh elastic band and button, or tassel, which may be bought quite cheaply, can be sewn on at home. A slit in the cover may be carefully darned and strengthened by a patch of silk on the inside, put on, of course, with the umbrella half closed. It is sometimes possible to straighten a bent tube, but in the case of a broken stick or broken ribs we must take the umbrella to an umbrella repairer.

AN EASILY-MADE STENCIL PLATE

IF we have a design or pattern which we should like to transfer to a book or sheet of paper and use the same pattern over and over again, we can do so by making a stencil plate in the following way, which, for outline designs, is very much simpler than the more elaborate stencil plates described on page 107.

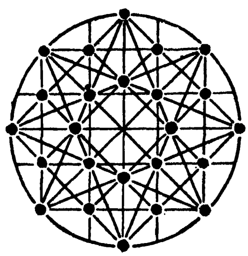
We must lay the drawing we wish to copy upon a sheet of thick paper, such as cartridge paper, and with drawing-pins fasten the two sheets together upon a table or drawing-board. Then with a pin or needle we must prick all over the outline of the design or picture, being very careful that we make the pinholes neat and clean and at fairly even intervals all over the lines.

It is essential that the paper and the picture from which we are making a stencil plate should be pinned down firmly to the drawing-board, and not allowed to move upon one another in the slightest degree while we are pricking the holes, or the outline will not be an exact copy of the picture we are tracing. Whether it is a flower, or a bird, or an ornamental design, it will, if the paper is allowed to slide about ever so little on the picture, be badly out of proportion. Now let us remove the drawing-pins and take away the upper picture. We shall find that the clean sheet of paper has the outline of the pattern transferred to it in a series of little holes. To multiply the pattern in a book or upon other paper we have only to pin this perforated sheet down and dust it over with powdered charcoal, a bag of which may be bought at any paint shop for a few cents. The charcoal should be put in a muslin bag and be shaken over the stencil, great care, of course, being taken that the stencil is properly fastened down.

The powdered charcoal will penetrate through the holes in the upper paper and the design will be transferred to the paper or book below. Then we can remove the stencil and ink in the design, or, if we so desire, color it with paint or crayons. The stencil plate can, of course, be used a great number of times; in fact, it will last for a very long time indeed if treated with ordinary care. If we find any difficulty in getting a piece of cartridge or other white paper that is stiff, we can, if we like, use a sheet of brown paper. This, if it is of a smooth nature, will do quite as well as the white, and, being tougher than ordinary white paper, will last very much longer.

THE ANSWER TO THE PUZZLE OF THE TREES

ALTHOUGH it had at first seemed to the gardener quite impossible that twenty-four trees could be planted in such a way as to make twenty-eight rows, with four trees in each, and these in a straight line, yet the gentleman about whom we read on page 4202 was soon able to show that this was no impossibility at all, but in fact quite an easy matter. He drew a plan which showed exactly how the trees might be placed so as to fulfil the conditions that he had laid down, and this plan, which the gardener used and followed in carrying out his master's orders, is given here so that we may see the manner in which the trees were planted. It will be noticed, of course, that the rows do not stand one after another like a regiment of soldiers on parade, but that was not required, and, of course, with only twenty-four trees, it would be impossible to plant the rows in that way. But there are, nevertheless, twenty-eight rows, each containing four trees in a straight line, and the gentleman drew the lines of each row on his plan, for the guidance of his gardener, so that there might be no difficulty about the planting of the trees.



THE PROBLEM OF THE TRAVELER'S DINNER

THE Arabs about whom we read on page 4202 were very much astonished at the decision of the magistrate, and thought at first that he must have made a mistake. But he repeated his decision, and when the traveler who had possessed three loaves protested that it was against all justice that he, who had only two loaves fewer than his companion, should receive only one coin, while the other man received seven, the magistrate offered to explain why he had ordered the money to be divided in this way.

"One of you had five loaves," he said, "and the other had three, making eight loaves in all, and then, when the third traveler came up and joined, the eight loaves were divided equally between the three of you. Now suppose each loaf to be divided into three equal parts, there would, of course, be twenty-four parts, and as you divided equally between three of you, each received what was equal to eight of these parts. But one traveler originally had five loaves, or fifteen parts, and as he only consumed eight parts, he must have given seven to the foodless traveler. The other man had originally three loaves, or nine parts, and as he consumed eight, he only gave one part to the foodless traveler, therefore, as you can see, my decision is quite fair; the seven coins go to the man who gave seven parts, and the one coin to the man who gave one part."

Both the travelers had to agree that this was quite fair, although they had not seen it in that light before, and the man of the three loaves wished he had been wise enough to take the three pieces of money that his companion had first of all given to him.

THE NEXT THINGS TO MAKE AND THINGS TO DO ARE ON PAGE 4379.

LITTLE PICTURE-STORIES IN FRENCH

First line: French. Second line: English words. Third line: As we say it in English.

Ceci est l'histoire d'un arbre de Noël, et d'un garçon qui s'appelle Henri.
This is the history of a tree of Christmas, and of a boy who himself calls Henry.
This is the story of a Christmas-tree and a boy named Henry.

Il avait beaucoup neigé et la terre était toute blanche de neige.
It had much snowed, and the earth was all white of snow.
It had been snowing hard, and the ground was white with snow.

Henri et ses amis firent des boules de neige. Ils eurent une bataille.
Henry and his friends made some balls of snow. They had a battle.
Henry and his friends made snowballs. They had a battle.

Dans la salle d'école il y avait un arbre de Noël, décoré de cadeaux.
In the room of school it there had a tree of Christmas, decorated of presents.
In the schoolroom there was a Christmas-tree hung with presents.

L'après-midi les enfants firent un homme de neige dans le jardin.
The after midday the children made a man of snow in the garden.
In the afternoon the children made a snow man in the garden.

" Je ferai un homme de neige pour l'arbre," se dit Henri.
" I will make a man of snow for the tree," himself said Henry.
" I will make a snow man for the tree," thought Henry to himself.

Il fit le corps, les bras, les jambes, et mit une pipe dans la bouche.
He made the body, the arms, the legs, and put a pipe in the mouth.
He made the body, the arms, and the legs, and put a pipe in his mouth.

Il plaça l'effigie sur le couvercle d'une boîte et pendit la boîte à l'arbre.
He placed the effigy upon the lid of a box and hung the box to the tree.
He put the figure on the lid of a box and hung it on the tree.

Le matin il courut à l'arbre et que pensez-vous qu'il trouva ?
The morning he ran to the tree, and what think you that he found ?
In the morning he ran to the tree, and what do you think he found ?

Une petite mare d'eau. Naturellement la glace avait fondu pendant la nuit !
A little pool of water. Naturally the ice had melted during the night !
A little puddle of water. Of course the ice had melted during the night !

A scene in the great Sahara Desert, showing a party of Bedouin Arabs moving to a new encampment.

HOW AFRICA HAS BEEN DIVIDED

EGYPT, ABYSSINIA, MOROCCO, LIBERIA, THE SAHARA, AND THE POSSESSIONS OF THE EUROPEAN NATIONS

CONTINUED FROM 4081

AFRICA is a huge, roughly-shaped, compact mass of land, three times as large as Europe, with a fifth of its surface covered with the largest desert in the world, and the rest of it rising from the surrounding seas, by great terrace steps, to high plateaus in the centre. Brimming rivers, with courses of from one to three thousand miles, plunge down the terrace steps to join the sea; mountains guard the coast nearly everywhere, the snowy peaks of those on the east side looking down on a most wonderful group of great lakes. Such is the face of Africa.

The burning sun, traveling overhead some part of the year in the greater part of Africa, looks down on millions of black and brown men—negroes and others—on millions of Arabs, on an ever-increasing number of white men from Europe, and on many of the beautiful and interesting animals with which we stock our Zoological Gardens. It is one of these animals, the elephant, with his valuable ivory tusks, that has helped to make history in Africa.

Now, the animals and the various tribes of negroes and other races, which are still in many cases heathen and uncivilized, have been there for an unknown length of time. They roamed through the great forests and lived by the wonderful rivers and lakes, for ever absorbed in finding food and avoiding enemies. The valuable rubber trees in these forests have also helped in a very great measure to make history in Africa.

The Arabs, from the other side of the Red Sea, crossed over to Africa at various times through the centuries, and found their way down the coasts, over desert and plain, over rivers and mountains, all over the land. Their coming brought woe to the black men.

The white men did not begin to come, except to the coasts within hail of Europe, till nearly the time of Columbus; and their coming also brought woe to the black men. The sorrow of Africa can be summed up in three words—slaves, ivory, rubber.

In the oldest maps, made by those who lived on the Mediterranean nearly 2,000 years ago, all that is shown of Africa is the north and north-western shores, and the narrow land of Egypt in the north-east corner near the Isthmus of Suez. This neck of land, joining Africa to Asia, was, in the past, the great highway of the nations from east to west. Over it passed multitudes of people—armies for conquest, embassies from great kings, merchants who went to and fro between Egypt and the East,

bridal and funeral processions. But neither the civilized old Egyptians nor the peoples of the northern shores knew much of the great continent behind the strip on which they lived, for the great desert stood as a barrier in the way. The ship of the desert, the long-enduring camel, was not used by the nomad tribes till the much later times of the Romans.

THE BRAVE MARINERS WHO FIRST DREW THE MAP OF AFRICA

We have to pass over many centuries, to the days of Prince Henry the Navigator and his brave Portuguese, of whom we read on page 3340 before much change is seen on the map of Africa. One of the results of their daring efforts, of their courage and perseverance, was that the discovery and shape of the outer rim of the great continent was made known to the world, and Africa, as a whole, could be sketched on the maps, together with the names of the settlements made gradually along the coasts by the Arab traders and the seafaring nations of Europe.

But the interior of the great Dark Continent—what of that? For a long time little or nothing was known in Europe about the vast heart of Africa, and so the map-makers were driven to fill up the blank white space with drawings of fancy animals. Indeed, those of us who were at school only half a century ago found Africa a very easy map to draw and learn—there were so few names in the middle of it.

THE JOY OF THE MEN WHO DISCOVERED THE SECRETS OF DARKEST AFRICA

On page 297 we read how strong, brave, and good men have followed each other, exploring the unknown parts of Africa, some with the view of helping to destroy the Arab slave trade and to teach the negroes, others to find out the sources of the rivers and to map out the country. Intense was their joy when the great lakes burst upon their astonished sight, and the snowy peaks came into view, and the thundering roar of mighty waterfalls on stupendous rivers deafened their ears as the boiling foam dashed high in the air. These were some of the secrets hidden so long in the heart of Africa. Of all the sorrowful ones that explorers have found, the saddest are the hard, beaten-down paths across Africa, trodden for centuries by the feet of gangs of miserable slaves, torn from their homes, which were often lake dwellings for safety. Sometimes they would carry ivory to the coast; but for none of them was there any return.

Many of the travelers are held in remembrance by the names of places on the map; and a chain of graves marks the white man's progress across unknown Africa. Much of it, owing to the great heat and the swamps, and the insects that carry infection, is very unhealthful and trying, especially to Europeans.

HOW THE SLAVE TRADE IS DISAPPEARING AS AFRICA BECOMES BETTER KNOWN

But the map is still filling up; the slave trade is gradually being suppressed; and steps have been taken to put an end to the cruelties practised on the natives who collect rubber.

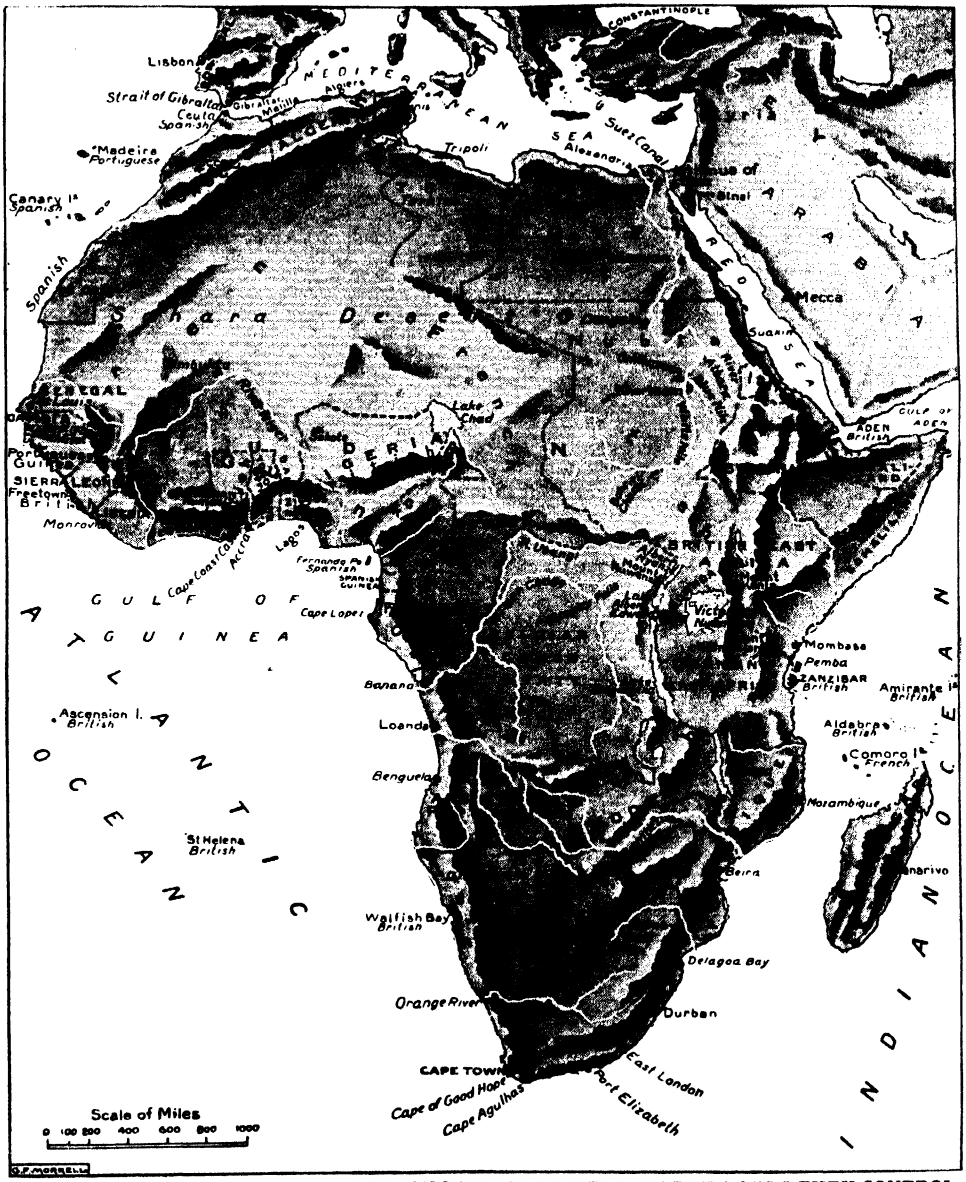
Let us now turn to the relief map on page 4299, and look more closely at the great continent, with the countries of the widely differing people that live upon it. It is not all new to us, for we know its shape by reading about the British Empire in Africa in that part of our book which begins on page 1781. Its southern tip points to the South Pole; round the Gulf of Guinea it faces westwards, and its eastern horn points to India.

Here, on this north-eastern stretch, it is divided from Asia only by the Gulf of Aden and the Red Sea, which pilgrims cross on their way to Mecca, and through which steamers pass on their way from India to Europe by the short cut through the Suez Canal. As we look at the narrowness of the Strait of Gibraltar, we think again of the Moorish warriors pouring over the sea into Spain. We are probably familiar with the eastern end of the wide, far-reaching deserts of the middle of the Old World, for we read about it in the story of Arabia, Syria, and Persia, on page 3856. Its western extension, separated from the eastern side only by the narrow Red Sea and the equally narrow fertile valley of Egypt, stretches right across the wide part of Africa to the Atlantic. This is the immense desert of the Sahara, which is about as large as the United States including Alaska. The greater part is rainless, sandy, rocky, or with poor, grassy lands; here and there are oases, such as we see in Asia, where springs of precious water, with refreshing vegetation, make life possible.

The hills that rise from the sun-

scorched Sahara are higher than any mountain in the great Appalachian range. The Atlas Mountains, on its northern boundaries opposite Spain, are as high as the Swiss mountains, with fine valleys and lovely scenery.

—Kilimanjaro and Kenia—both close to the Equator, and between the great lake, Victoria Nyanza, which is larger than Maine, and the sea. Both are taller than Mont Blanc by some thousands of feet.



AFRICA, WITH THE NAMES OF EUROPEAN POWERS PRINTED ON THE LANDS THEY CONTROL.

The Abyssinian highlands, south-west of the Red Sea, consist of high and rugged mountains rising from a series of tablelands, with deep, dark ravines between. South of the Abyssinian heights rise the twin giants of Africa

The land in this mountainous region sinks to the sea in particularly steep terraces. The hilly borders of the high inland tablelands sometimes come close down to the sea; sometimes there is a varying width of coastal plain, generally

very unhealthful for Europeans. Both act as guards that defend the country.

THE NILE, THAT FLOWS IN EGYPT LIKE A MIGHTY THOUGHT THREADING A DREAM

There is at least one immense river to every side of Africa. On the north, draining to the Mediterranean for over 3,000 miles, is the Nile, one of the most interesting and wonderful rivers in the world, "flowing through Egypt like some grave, mighty thought threading a dream." The first cataract, or rapid, on the Nile is hundreds of miles from the sea.

Into the Indian Ocean on the east side pours the great Zambesi River, opposite the island of Madagascar. Navigation is very difficult near its mouth. Its tributary, the Shiré, drains Lake Nyassa, and is of great use in passing through the country. The magnificent Victoria Falls, high up on the Zambesi itself, can only be compared with Niagara. The great river suddenly dashes over a cliff about 330 feet high, with a deafening roar, while the spray is shot high in the air. Truly it is one of the wonders of the world!

From the high tableland beyond the group of great lakes rises the mighty Congo, nearly 3,000 miles long; it circles away to the western side of the continent to empty its immense volume of gathered waters into the Atlantic. The explorer Stanley marched for five months through unbroken forests in its basin, and his name is commemorated in the Stanley Falls. There are over 6,000 miles of navigable waterway in the Congo and its tributaries, all of which enter it above the deep gorge through which it reaches the sea by many falls.

THE THREE GREAT RIVERS OF THE FUTURE THAT WATER THE HEART OF AFRICA

The Niger, with its tributary, the Benue, draining into the Gulf of Guinea, is also very important in opening up a way to some of the richest land in Africa. It touches the Sahara on the south, near Timbuktu, the central meeting-place of the caravan traffic.

The Zambesi, Congo, and Niger may be called rivers of the future, so vast are the resources to be opened up in their basins. The Nile has a great past as well as great prospects. For countless centuries it was worshipped as a god, so mysterious and wonderful are the blessings it brings to the country it has made. The mystery has disappeared since the sources of the Nile were discovered; and no longer are beautiful thanksgiving hymns sung to the Nile, nor offerings cast into its placid bosom; but it steadily goes on making and blessing Egypt. "Egypt is the gift of the Nile."

Now, Egypt is practically a long, narrow oasis in the great mid-world desert. In shape it has been compared to a lily with a bent stalk. The lily is the delta on the Mediterranean, and the stalk is the long course of the river, with the few miles of green and fertile land that lies upon either side.

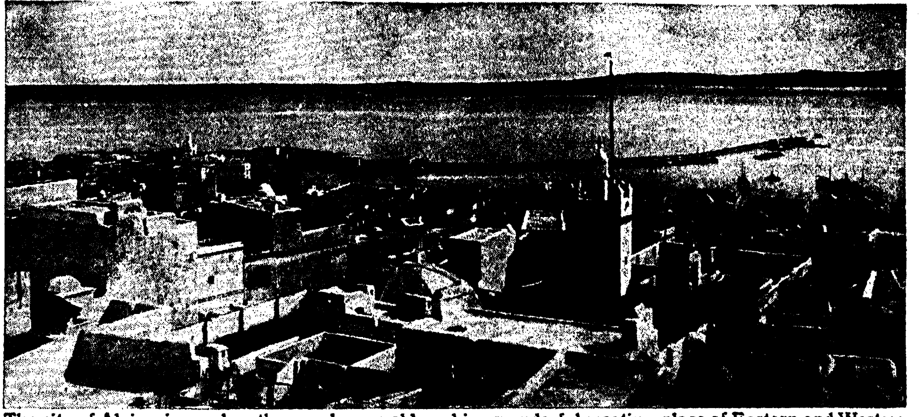
HOW THE NILE COVERS EGYPT EVERY YEAR WITH A MANTLE OF FERTILE MUD

We might ask how the fertile soil, under which lies the desert sand and rock, got there. Every year through the centuries, except in black years of famine, the Nile at certain seasons has swollen and risen from its bed, flooding the lower country till it all looks like a sea of many islands, with the villages and farms standing out above the expanse of water. A mantle of delicate green is thrown over all a few months later, when the water has subsided and has left behind the layer of mud which makes Egypt so fertile. Three crops a year grow in the fields, enriched and refreshed by the waters of the Nile. It is impossible to sail or steam along the broad river-highway without being filled with wonder at the stupendous remains and ruins on its banks.

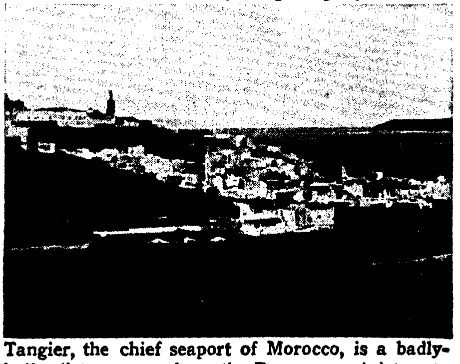
We can enjoy the grand buildings and enter into the old life of the country in another part of this book, so let us now take up the story of Egypt when the Egyptians were under the Romans.

When Britain was but an outlying, barbarous province of the great empire, Egypt, in its south-east corner of the Mediterranean, easy of access to almost every part of the Roman world, was one of the most civilized and important of its provinces. We have seen how distant Britain had to be abandoned when the empire grew weaker in the fifth century. Egypt remained under the Eastern, or Greek, Empire after the great division into East and West, and had its share of attacks and misfortunes with the rest of that long-dying Power.

THE CITIES OF NORTHERN AFRICA

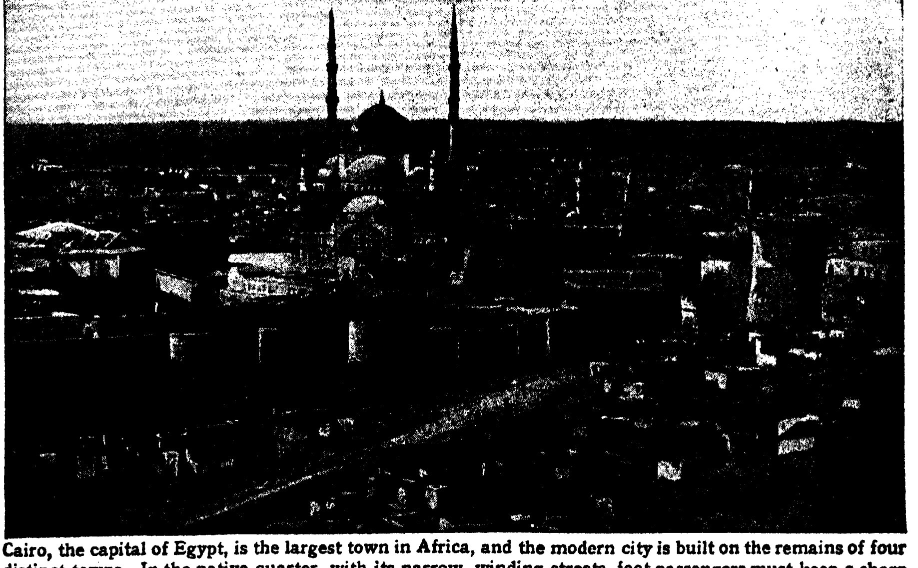


The city of Algiers is nearly a thousand years old, and is a wonderful meeting-place of Eastern and Western life. For centuries it was misgoverned by its Turkish deys, or rulers, but in 1830 the French took Algiers and have made it a fine city. Its great glory is an avenue with a magnificent terrace built by an Englishman.



Tangier, the chief seaport of Morocco, is a badly-built, dirty town, where the European ministers to Morocco live. At one time it belonged to England.

Mazagan is another Moroccan seaport, which has a considerable trade in grain, almonds, wool, and oil. This is the market-place in the Jewish quarter.



Cairo, the capital of Egypt, is the largest town in Africa, and the modern city is built on the remains of four distinct towns. In the native quarter, with its narrow, winding streets, foot passengers must keep a sharp look-out to avoid being trampled upon by camels and donkeys. Cairo is noted for its beautiful mosques.

HOW THE PERSIANS CONQUERED EGYPT, BUT WERE DRIVEN OUT

The Persians, early in the seventh century, held Egypt for ten years, but were forced by Heraclius to retire. We read of this gallant emperor on page 3188. In these centuries there were great difficulties about religion. When the Egyptians accepted the Christian faith with the rest of the empire, they kept many ideas and customs connected with their ancient faith.

There were endless persecutions and difficulties between those who thought one thing and those who thought another, and the feeling became very bitter among these different sects.

When the Mohammedan troops of the Caliph Omar, about whom we read in the story of South-west Asia, on page 3858, appeared before Alexandria, the great seaport of Egypt, there was no united front in Egypt against these followers of Islam, who were able to carry everything before them.

And so Egypt passed under the sway of the caliphs and the Arab tribes, many of whom had long before made settlements round the east coast, and spread not only over Egypt and North Africa, but ever farther and farther inland. On the whole, the Egyptian Christians, or Copts, at first had a better time under the rule of the caliphs than they had had under the Greek Christian emperors; but the country was neither developed nor well governed in those luxurious days, and it was often divided by quarrels about religion. After a time began the struggles with the conquering Turks.

THE WISE SALADIN, WHO DID MUCH FOR EGYPT AND ENCOURAGED LEARNING

The great Saladin, at the end of the twelfth century, did much for Egypt by his wise government. He fortified Cairo, the capital, situated on the banks of the Nile, about 100 miles from the sea, and strengthened the country against invasion, put down rebellions, seized ports on the Red Sea, and sent expeditions in various directions. Saladin's brother and nephew carried on his efforts. The methods of storing the Nile's overflow and carrying it where needed were improved, and trade and learning were encouraged.

It was in these days that a famous cavalry corps called the Mamelukes was developed from bodyguards and brigades of strong young Turkish slaves. They gradually rose in power till the strongest and cleverest of these troops were able to make themselves in turn sultans and masters of Egypt. The story of their power, which lasted nearly 300 years, reads like a romance. At first slaves, then trained soldiers, they became chiefs and sultans.

THE SPLENDID MOSQUES THAT THE MAMELUKE RULERS BUILT FOR EGYPT

The Mameluke rulers were great builders, as many of the splendid mosques, especially that of the Sultan Hassan, and other buildings in Cairo, still testify. When the Ottoman sultans found their way to Constantinople, it was not long before they determined to conquer Egypt. In vain were extra taxes levied in the doomed country, fortifications erected, and the army strengthened. The fatal battle was fought near Cairo in 1517; street by street the capital was stormed, and the massacre of its people was carried on day after day for a whole week.

HOW EGYPT BECAME A TURKISH PROVINCE AND LOST MUCH OF ITS WEALTH

So Egypt passed to another stage in its long history, and became a province of Turkey, but it remained practically under the rule of the Mamelukes, with a ruler, or pasha, sent from Constantinople. The province, like many others, was taxed to the uttermost, and became poorer not only from that cause, but also because much of its trade passed from Alexandria to Constantinople. It also lost, about this time, the large sums it had levied on all goods passing to and from India over the Isthmus of Suez, for Vasco da Gama had found the sea-route to the East round the Cape of Good Hope.

More than 200 years passed by, during which the Mameluke beys, or governors, under a nominal Turkish chief, fought and struggled with each other, entertained lavishly, built and restored fine mosques, and encouraged Mohammedan learning and the arts, when suddenly, and most unexpectedly, the wave of upheaval set in motion in France by the Revolution reached the extreme end of the Mediterranean.

Napoleon, longing to overthrow British power in India, determined to master the East by attacking Egypt. He succeeded in bringing his fleet and army

THE DAILY LIFE OF THE PEOPLE OF CAIRO

Cairo has a large European population. Its picturesque part is the native quarter. This is truly Oriental, and the lattice-work of the houses shows Saracen art at its best. The streets are thronged, and the fruit merchants do a good business.

The streets of Cairo are narrow and winding, and the buildings present a never-ending variety of style. A traveler in the native quarter might think himself in some fairyland of the "Arabian Nights." The lemonade-seller is a familiar sight.

An old Arab writer has said that "he who hath not seen Cairo hath not seen the world; its soil is gold; its Nile is a wonder; its houses are palaces; and its air is soft, its odor surpassing that of aloes-wood, and cheering the heart." Perhaps none of its people has done so much to beautify the native city as the craftsman who works in ivory and wood, and produces the famous lattice-work. He uses his left foot as a third hand, and, because of his skill in the use of this foot, he is known in the city as the "three-handed man."

The photographs on these pages are by Messrs. Underwood & Underwood and Messrs. Valentine.

from Toulon to Alexandria, and fought the famous battle of the Pyramids before Nelson destroyed his fleet in the Battle of the Nile. We know how the brilliant successes of General Kléber, after Napoleon had returned to Europe, dwindled into complete failure, and how in the end 24,000 French troops were taken back to France in English vessels. The English themselves left Egypt soon after.

THE CRUEL MOHAMMED ALI, WHO PUT AN END TO THE MAMELUKE RULE

After this a dreadful tyrant, named Mohammed Ali, arose in Egypt. An Albanian by birth, he made his way upwards by great ability, and became pasha. He pushed his conquests to Arabia and to the Sudan, seized all the landed estates in Egypt itself, and extorted money and service from the miserable peasants, or *fellahin*, most of whom are descendants of the old Egyptians. At last he managed to get 500 of the Mameluke beys into the citadel of Cairo, and massacred them all.

We perhaps know the miserable part he and his son played when the Greeks were striving for independence, and of how Mohammed Ali finally made a brilliant success against the Sultan of Turkey, till then nominally his master. But the result of his successes were speedily lost by the rebellion of the conquered against his cruelties and oppression.

The chief event of the reign of Said Pasha, who was Mohammed Ali's youngest son, was the granting permission to the French engineer, De Lesseps, to make the Suez Canal. This stupendous work, nearly 100 miles long, was carried out in thirteen years, making Africa an island instead of a peninsula; and the world's ships now steam through the canal on their way north and south, carrying much of the freight and nearly all the passengers to the Far East.

THE PEACE AND PROSPERITY BROUGHT TO EGYPT BY GREAT BRITAIN

Egypt's trade had a period of prosperity in supplying cotton, which grows well there, when the American Civil War cut off the crop grown in the United States; but the country's money affairs were so mismanaged that little benefit was gained. This was in the time of Ismail, the successor of Said. Ismail, who was extravagant, and perhaps greedier than any of the rulers who had gone before him, brought the country to ruin. He burdened Egypt, the fertile part of which was not more than a third of the size of New York State, with a debt of $400,000,000. To gain the title of Khedive, or prince, he increased the yearly tribute, to be paid to Turkey, ten times. This meant that the tremendous sum of over $3,000,000 a year, in addition to the taxes imposed for the use of Ismail himself, were wrung from the unfortunate peasantry and sent to Constantinople.

To put a stop to his misrule, the British government and the French government united to ask the Sultan of Turkey to put Ismail out of his office, and make his son, Tewfik, Khedive in his place. This was done, and after that the British and French took up the questions of taxation and the oppression of the *fellahin*. After a time the French took no further share in the government. But when the British government had to send an army to put down a mutiny and restore order, they thought it better to keep what is called an army of occupation in the country. They also sent officials to see that the Khedive ruled with justice. The real ruler of Egypt, however, is a British official called the British Agent and Consul-General. Since this change in government was made the country has been well governed. The taxes have been cut down to a low limit. The officials are not allowed to oppress the people, and so the *fellahin* have money for themselves. Railways have been built, and the great dam of which we read on page 5415 has been commenced and finished; schools are being established and trades taught; the laws are kept and justice is done.

In 1914 the Khedive showed a desire to go to the aid of Turkey in the Great War. This would have cut off Western Europe from the Far East. Therefore the Khedive was deposed; Egypt was declared to be independent of Turkey, and placed under the protection of the British Empire, and Hussein Kamil, a son of Ismail, was made Sultan.

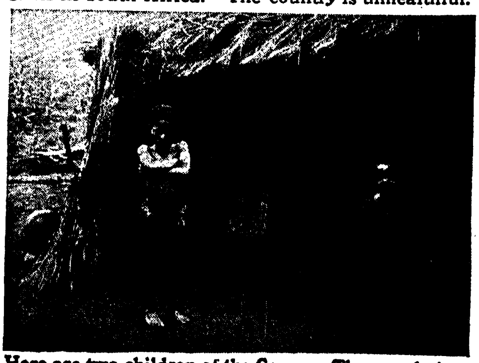
Since the Nile dam was finished a great deal of irrigation has become possible, and large tracts of land have become as fruitful as the Delta. The country has become prosperous enough to commence to pay off its debt, and as it is now independent of Turkey, the large sum hitherto

THE PEOPLE OF TROPICAL AFRICA

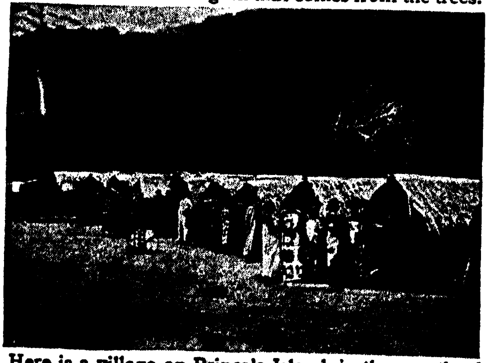
In Uganda, which is now a British protectorate, missionaries have done splendid work. It was there that Bishop Hannington sealed his testimony with his blood. Here is a typical village market, and, as we can see, the natives are happy and prosperous, very different from some other African races.

This is a village in Portuguese East Africa, which lies between the Indian Ocean and the British possessions in South Africa. The country is unhealthful.

Much rubber is obtained from Portuguese East Africa, and here we see a rubber plantation near Beira. The rubber is a gum that comes from the trees.



Here are two children of the Congo. The population of this district, which belongs to Belgium, is about thirty millions and includes different races.



Here is a village on Prince's Island, in the mouth of the Congo River opposite Boma, the seat of the Government and the home of the Belgian Governor-General.

paid to the Sultan as yearly tribute is saved.

There have been endless difficulties in the part of the Sudan which lies in the basin of the Nile. Sudan means the land of the blacks. It stretches right across Africa south of the Sahara — a fertile, well-watered, and very hot belt of country, now divided among various Powers. For sixty-five years the Sudan, as far as the great lakes, had been held by Egyptian governors, whose chief idea was to get money out of the people, whom they sorely oppressed, especially in the terrible trade of slave-raiding.

HOW GENERAL GORDON WAITED FOR THE HELP THAT CAME TOO LATE

In Ismail's time, General Charles G. Gordon, a famous Englishman, was made Governor, and did good work for some years. After his resignation, tax-gatherers and slave dealers again oppressed the people. Taking advantage of their discontent, a Mohammedan preacher named Mohammed Ali—who called himself a prophet and was given the name of the Mahdi—raised a rebellion. This was about the time that the British had begun to reform the Egyptian government, and after the Egyptian army had been badly defeated by the Mahdi's troops, General Gordon was again sent out to try [illegible] restore order.

He succeeded in h[illegible]g numbers of Egyptians to escape [illegible] the Mahdi, but was himself sur[illegible]ded by the Mahdi's forces at the ci[illegible]f Khartoum. Nothing could exceed th[illegible] heroism [illegible] his defence, but it was hopeless. He was killed before aid [illegible] reach him.

For eleven ye[illegible] Sudan was left, cut off from the [illegible] in an awful state of desolation, i[illegible] the people were starving and dy[illegible]der the tyranny of the Mahdi. Then General Kitchener, with a carefully trained army, took Khartoum and gained a brilliant victory at Omdurman. Since then railways from Egypt have penetrated to Khartoum, and connected it with the Red Sea. And in memory of the hero who lost his life, Gordon College has been built, to help on the education of the people in this great district.

It is hoped that by use of irrigation the Sudan will some day be made as valuable as Egypt itself. Since that the country has been given settled government, hundreds of thousands of acres have been added to the cultivated ground, and the growth of grain as well as the raising of cattle is increasing. The possession of the country of the upper waters of the Nile is necessary to Egypt, so dependent is it on its great river to water the soil.

THE TORRENTS OF RAIN THAT CARRY THE MUD OF ABYSSINIA INTO EGYPT

When the tributaries of the Blue Nile and Atbara were traced to the highlands of Abyssinia, the mystery of the rise of the Nile and its fertilizing mud was solved. The torrents of tropical rain tear down the earth from the gorges and the cliffs, and the muddy water rushes down through Nubia over the chain of cataracts to the almost level course from Assuan to the sea. It is at Assuan that the great dam across the river has been made to regulate the supply of water. It means famine and bitter sorrow to the people of Egypt when the Nile rises too little or too much, for then the fine crops of cotton, corn, flax, sugar, and hemp fail, and there is famine in the land. But the water stored in the great reservoirs not only irrigates lands that up till now were dry and barren, but supplies enough for use in dry seasons.

Abyssinia is an independent state that has had many passages at arms with European nations. The hardy mountaineers adopted Christianity in early times; they have now many curious customs and beliefs.

At Khartoum the Blue Nile joins the White Nile, th[illegible] stream from the British district of Uganda, where it drains the Victoria and Albert Nyanza —the word Nyanza means lake. Few countries can give more exciting adventures than Uganda and the district between it and the sea. The railway now connects it with Egypt and with Mombasa, the gate of British East Africa.

A COUNTRY WHERE PEOPLE SEE LIONS AND GIRAFFES FROM THE TRAINS

Travelers speak of seeing lions, giraffes, and zebras from the carriage windows. Some of us would dread to get out at the stations! Former President Roosevelt spent months here shooting lions and hunting the huge hippopotamus and rhinoceros on the river-banks.

We read in the story of Spain, beginning on page 3339, how the Mohammedans swept along the northern states of Africa—often called the Barbary

States, from the early inhabitants, the Berbers—on their way to turn the European Pillar of Hercules into the Rock of Tarik, or Gibraltar.

For some hundreds of years they remained in undisputed possession of the coast, and then Spain began to carry its arms across the sea against the hated Moslems. In the sixteenth century pirates established themselves in the harbors of the coast; and Charles V. made many efforts, only partly successful, to dislodge them. These pirates, or corsairs, were men of extraordinary daring, and by attacking merchant ships and wealthy towns they secured great riches for their booty.

Many and grievous are the stories of the sufferings of their prisoners. They made slaves of them if large ransoms were not paid. Eventually the Turks were drawn into the almost endless contest, and succeeded in obtaining for a while the chief power in North Africa. Many European states paid large sums to buy freedom from the attacks of the corsairs, who carried on their evil ways till less than one hundred years ago.

The United States sent a fleet against them; and, at last, with the help of the English and the Dutch, matters improved; but it was not till 1830 that the French finally took Algiers and destroyed for ever the nests of the pirates. They set the captives free, and founded, after many difficulties, the French empire in Africa, which now spreads over the Central and Western Sudan, over the basin of the Niger, and along the western coast of the great continent. In Morocco, the most westerly of the Barbary States, live Moors, descendants of the Mohammedans who conquered it in the seventh century, Berbers, [illegible] numbers of Jews and negroes. Like Egypt, the country has a sultan at the head of the government. In name he has absolute power, but, in reality, part of the country is under the protection of France, and part under the protection of Spain. Morocco was for a long time in a very bad state of misrule, and France and Spain have undertaken to see that the government is carried on in an orderly manner.

Turkey in Africa, once very large, does not exist at all, as Italy has taken Tripoli, Tunis is under French protection, and the Sultan of Egypt is prac-

THE KING OF PORTO NOVO, IN DAHOMEY, PRESIDING OVER A [illegible] HIS MINISTERS

tically independent of the Sultan of Turkey.

If we look at the map on page 4299, or make a map of Africa, marking the chief divisions, and set in each division little flags of the countries who own them, we shall gain a good idea of what is meant by " the scramble for Africa." Except in a few cases, as we have seen, the uncivilized black races and tribes have been unable to hold their country either against Arabs or white men. So when particulars began to be known about the vast interior, at a time when most European nations were desiring room to expand across the seas, they turned to " unoccupied " Africa, each seizing the parts that were most easy to annex. The flags make a gay fringe right round the coast of the great continent.

THE FLAGS OF THE NATIONS THAT FLY ALL ROUND THE AFRICAN COASTS

Let us start from Egypt, with its crescents and stars. Tripoli comes next, with the Italian flag; Tunis and Algeria must be pegged out with French flags, stretching far south beyond the mountains into the Sahara. Some day the French hope to push a railway across the desert to their possessions on the Niger. Morocco has its own red flag, and that of Spain signals from Ceuta, the Southern Pillar of Hercules, to the Union Jack that flies on the rock of Gibraltar.

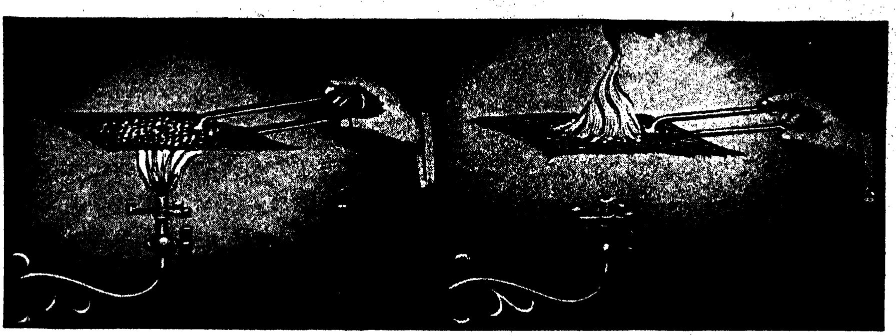
Spain also owns the Sahara coast from Morocco to Cape Blanco, where the enormous French West African possessions begin. The independent striped flag of Liberia, the state of freed slaves, waves on the coast of Guinea, surrounded by numbers of European flags, all marking the various divisions now owned by their countries. Then, on the Congo, we have French flags again marking out the territory reaching up to Lake Chad, that curious lake, sometimes as large as New Jersey and sometimes a swamp.

THE CONGO STATE, THAT IS NOW UNDER THE RULE OF BELGIUM

The Congo State, now under the rule of the Belgians, has only enough room on the coast to plant its flag, though it expands large and square in the interior to Uganda and German East Africa. Angola is Portuguese, so is a long strip watered by the Zambesi on the east coast, opposite Madagascar, which from end to end is French. South of Angola lies German South-West Africa. The southern tip of the continent needs many British flags to mark out its involved boundaries far up into Rhodesia. Between Rhodesia and British East Africa is the large tract of German East Africa, with the three beautiful lakes of Nyassa, Tanganyika, and Victoria Nyanza on its borders. On these great lakes are busy steamers which connect with the growing railway lines. From Zanzibar, celebrated for its cloves, the caravans for the interior fit out; and many are the stirring adventures with slave-ships on this part of the coast. Italian flags wave on the horn of Africa, reaching up to the Gulf of Aden, where British Somaliland and French Somaliland separate Italian Somaliland from the Italian colony of Eritrea, which cuts off Abyssinia from the Red Sea. In the Great War, the German possessions in Africa were taken from her by the nations allied against her. Where the German flag will fly in Africa now entirely depends on the terms upon which peace may be made.

Railways have been begun by all the powers who now claim the right to govern Africa, and many miles of these railways have been built. This is a good thing for the natives, for enterprize like this strikes at the very root of the slave trade and the cruelties connected with the gathering of ivory and rubber; for rapid travel opens up dark places and draws together the great and varied interests of the huge continent. And it is this lighting up and linking up that alone will make it possible for Europeans to carry out the obligations they take upon themselves when they hoist their flags over vast numbers of uncivilized natives in Africa. The trade of this vast country on either side of the railway is in its infancy, but great prospects are foreshadowed. These prospects can only be made realities by the people of the white races, and in doing so the temptation to oppress the weak and ignorant natives always exists. But this temptation must be resisted. If the wealth which lies in this great region is to be of real benefit to the world, part of it, at least, must in justice be spent in providing for the natives the education suited to their needs, and in raising them to a higher level of civilization, and bringing to them the blessings of peace and justice.

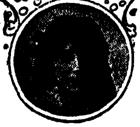
THE NEXT STORY OF COUNTRIES IS ON 4397.



These pictures illustrate the principle of the miner's safety lamp. If a piece of metal gauze be held over a gas-jet and the gas is lighted from below, the gas that has passed through the gauze and is on the other side will not ignite. If the gas be lighted from above, it will not ignite below the gauze.

HOW HEAT TRAVELS

CONTINUED FROM 4233



We know how heat travels by what is called convection and conduction, and now we may learn how these facts about heat were applied by a very famous Englishman, in what is called the safety lamp. This was invented about a century ago by Sir Humphry Davy, and it depends upon the fact that metals conduct heat quickly.

If we take a sheet of wire gauze and see what we can do with it to the flame of a gas-jet, we get some curious results. For instance, we can push the flame about by means of the piece of gauze, and if we hold the gauze a little distance from the gas-jet before we light the gas, we can make a flame burn on the side of the gauze away from the gas-jet, but that flame will not spread to the space between the gauze and the hole from which the gas is coming.

Now, the reason why the flame does not spread is that the gas only burns if it is hot enough, and the gauze is such a good conductor of heat that it takes up and spreads out along itself the heat made by the burning gas, so that the gas on the other side is not made hot enough and cannot burn. These facts applied in the safety lamp have saved countless lives. Davy's lamp is simply an oil-lamp which, instead of having a glass tube round the flame, has a tube or cylinder of wire gauze.

If coal-gas is in the air of the mine, it will pass through the gauze, and, when it is made hot enough by the flame, it will burn; but the flame of the coal-gas will not spread outside the lamp, because the wire gauze conducts the heat away so quickly that the coal-gas outside cannot take fire. Of course, when the miner notices the flame of the coal-gas burning inside his lamp, he will know that there is danger, and act accordingly.

Even with the safety lamp there is always a risk, for nothing is more generally true of mankind than that, in time, we grow accustomed to risks, and think no more of them. The consequence is that men become careless. The gauze of the lamp might be cracked or broken, and the miner might not trouble about it; his lamp might blow out, and he might strike a match to light it again.

Further, explosions in coal-mines are by no means due only to coal-gas; they are very largely due to coal-dust. For all these reasons, something better than the safety lamp is wanted. All proper mines are now lit by electricity, and no mine should be lit in any other way. This, of course, does not mean that we should pay any less respect to the great man whose simple device saved so many lives during so many years. We must now go back for a little

while to the other kind of heat, which is called *radiant heat*. We must do so because we are discussing the ways in which heat travels, and therefore, besides conduction and convection, we must mention *radiation*, these being its three ways of traveling. If a thing is hot enough, it is not only giving off heat by conduction to the air around it, but also, like the sun or a hot poker, it produces rays of radiant heat, and in so doing loses its own heat, for, of course, nothing comes from nothing.

Radiant heat, we know, consists of waves in the ether. Its laws are simple. First, it travels in straight lines, just like the very similar kind of radiation which we call light; secondly, radiant heat, like light, can be reflected from a surface, and is reflected according to the same laws as light; also, just as light is bent when it passes from air into water, so also is radiant heat.

THE LAWS OF RADIANT HEAT THAT ARE LIKE THE LAWS OF LIGHT

Knowing, as we do, that radiant heat and light are as like one another as the sounds produced by one octave of the piano are like the sounds produced by the next octave, we shall not be surprised that the laws of radiant heat are the same as those of light.

It is true of radiant heat and of light and of sound and of the action of gravitation and of the power of magnetism, that the force of them at any given point varies in a regular way according to the distance of that point from the source of the heat or light or sound, or whatever it is. A hot thing, or a bright thing, or a noisy thing, is one-fourth as hot or bright or noisy when its distance is doubled, one-ninth when its distance is trebled, and one-forty-ninth if its distance be made seven times as great as it was at first.

These are just instances, and we shall notice that 4 is 2 times 2; 16 is 4 times 4; 49 is 7 times 7. Now, when any number is multiplied by itself, the result is called the square of that number. So we see that the law in this case is that when the distance is increased, the power is diminished, not in proportion to the distance, but in proportion to the square of the distance. Instead of having one-seventh of the power when it is moved to seven times the distance, the hot thing, or whatever it is, has only one forty-ninth part of the power. This is not because anything is lost, but simply because the action of the thing we are trying is spread out more the farther it is away, and as the amount of this spreading out is the same in every case, we understand why the law should be true for heat, light, sound, gravitation, and everything else.

AN IMPORTANT LAW OF NATURE THAT GOVERNS HEAT

The proper way of saying this is that the intensity varies inversely as the square of the distance. The word inversely is put in to mean that the greater the distance, the less the intensity. If the intensity became greater as the distance became greater, then we should say that they varied directly instead of inversely—which, literally, means upside-downly.

We know very well that light will travel through certain things, such as glass, which we call transparent, and we should expect that just as certain things are more or less transparent to light, so things ought to be more or less transparent to radiant heat. The special name for this property does not matter. We may call it transparency to heat, and all we need now remember is that things may be transparent to light which are not transparent to heat, or they may be transparent to heat and not to light. For instance, water will let sunlight through, but it will stop altogether the radiant heat, which is really part of the sunlight, just as completely as the thickest and blackest shade would stop the visible light itself.

WHAT HAPPENS WHEN RADIANT HEAT CANNOT PASS THROUGH A SUBSTANCE

On the other hand, there are fluids which are almost quite transparent to radiant heat. Nothing, of course, is ever lost, and if the water is opaque to radiant heat—that is, if heat cannot pass through it—it does not mean that the radiant heat is lost. What happens is that the water becomes warm. If a fluid has the property of being transparent to radiant heat, then, in so far as it is so, it will not be made warm even in the blaze of sunlight. Different kinds of substances vary very much in their behavior as regards radiant heat. Just as water will stop and absorb radiant heat falling upon it, while other things will let the radiant heat through,

so one kind of thing will radiate heat from itself very easily and another will not. A great deal depends upon the surface of the thing, and, in general, dull surfaces absorb radiant heat more readily than bright surfaces.

WHY A THING CAN RADIATE ONLY WHEN ITS SURROUNDINGS ARE COOL

When we say that something is radiating, we assume that its surroundings allow it to radiate, and a great deal depends on these surroundings, and especially upon their temperature. A thing radiates only when its surroundings are cooler than itself; if its surroundings were hotter, it could not give heat to them, but they would have to give heat to it. The general rule is that the greater the difference in warmth, or temperature, between a hot radiating body and its surroundings, the greater is the rate at which it radiates and becomes cool.

We must hold fast to the truth that something is never obtained from nothing. Heat radiation, as we know, is a form of energy or motion in the ether. It is a kind of power. If it is produced by anything, that thing loses in proportion; therefore, every radiating body tends to become cool, and, sooner or later, unless new sources of energy are supplied to it, must become cooled down to the temperature of its surroundings, and then its radiant days are over.

These facts are of enormous importance in the great world of astronomy. When we come to study the different bodies of the solar system, we find how important are the laws of radiation. The moon, being very small, has not been able to hold its atmosphere to itself.

THE MOON'S RAPID CHANGES FROM HOT TO COLD AND FROM COLD TO HOT

The solid surface of the moon is naked and exposed to the sun's heat, and when the sun is playing upon any part of it, that part must become intensely hot. But when that same part is turned away from the sun, it begins to radiate back into space the heat it got from the sun. In so doing it soon becomes intensely cold. In other words, the fact that the moon has no atmosphere means that its surface is constantly being subjected to many very rapid changes of temperature. We cannot believe that life could possibly flourish under these conditions; and if it be true that there are traces of humble vegetable life upon the moon, that life must be protected from the violent changes of temperature by lying deep in shaded valleys where it is possible that a few traces of an atmosphere still remain.

Now let us consider the case of the earth. Like other bodies in the universe, the earth radiates its heat into space. The question is how far the atmosphere affects this radiation. The atmosphere, as we have already learned, is mainly made of two gases, oxygen and nitrogen; about one part of oxygen to four of nitrogen.

It has been found that both of these gases are very transparent to radiant heat; therefore, so far as they are concerned, the surface of the earth is almost as nakedly exposed to the sun's great heat as the surface of the moon is, and, on the other hand, can radiate away heat at night almost as readily as the moon is able to do.

HOW THE WATER-VAPOR IN THE AIR PROTECTS US FROM THE SUN'S RAYS

There is a most important gas in the air that we have not yet reckoned with, and that is gaseous water, or water-vapor, which is always more or less present in the atmosphere. We have already learned that liquid water is very opaque to radiant heat, and the same is true of water in all its forms. Therefore, the gaseous water in the atmosphere is, for one thing, a veil mercifully protecting us from the heat rays of the sun, and it is a barrier to the radiation of heat from the earth: both the heat of the earth itself and the heat which the earth is always getting from the sun. This influence of the water-vapor in the atmosphere is one of the most important of the many all-important services performed by water for life.

Lastly, let us consider the case of Mars. The measure and the changes of heat on the surface of Mars must depend to a very great extent upon its atmosphere, and upon the gases that make up that atmosphere. We have learned for certain, after many years of study and doubt, not that Mars has an atmosphere, for that was known, but that there is water-vapor in it. As in the case of our own earth—though to a less degree, for there is less

of it—this water-vapor must catch the heat of the sun, and must interfere with the loss of heat by radiation from the surface of Mars. All this bears very deeply upon one of the most interesting questions in the world—the question of the existence of life, and especially intelligent life, upon Mars.

The moon, the earth, and Mars, like the sun itself, and like all other bodies, small and great, which are hotter than their surroundings, lose heat by radiation, and, as we have often noticed before, the rate at which a body cools by radiation depends to a great extent upon its size. If we consider the case only of round bodies, the bigger they are, the greater is the amount of matter in them compared with the size of their surface, and, therefore, the more slowly they cool. Owing to this simple law affecting radiation, we can understand why the huge sun is far hotter than Jupiter, Jupiter hotter than the earth, the earth hotter than Mars, and Mars hotter than the moon, though, to begin with, the matter composing these different bodies was all of the same temperature.

RADIUM AND OTHER ELEMENTS THAT GIVE OFF HEAT WITHOUT BURNING

One of the most astonishing discoveries of recent times is that there are certain elements which give off radiant heat unceasingly, though they are not burning, though they are getting no heat from outside, and though they are not cooling down from a state of great heat. The best known of these elements is radium; but there is really quite a large number of them, all related in a regular way, and radium is merely one of the set. These *radio-active* elements, as they are called, have many wonderful properties, some of which we have studied; but one of the most remarkable is their power of ceaselessly producing heat, which they radiate out in all directions.

For several years after radium was discovered, the great question for science to answer was: Where in the world did this heat come from? A few rash and foolish people, not waiting to think, and eager to find fault with the work of those who think and study Nature, declared that radium upset the great law of the conservation of energy, which, as we know, says that nothing is added and nothing is destroyed, but that everything is changed. These people said that this law of the conservation of energy, which is for science the basis of all knowledge of the universe, was proved false, because here was an element, radium, which went on day and night without stopping, and made heat which, they declared, came from nowhere.

A LAW OF THE UNIVERSE TO WHICH THERE CAN BE NO EXCEPTION

Now, it is quite certain that if this were so, even only in this one case, and if the amount of heat made were ever so tiny, and if in the whole wide universe there were only just one-millionth part of a grain of radium that made heat out of nothing, then the law of the conservation of energy would not be true, and everything built upon it would have to come down.

Sometimes we say the exception proves the rule, but it all depends. In such a case as this, the tiniest exception that was a real exception would destroy the rule. Either the law of the conservation of energy is true altogether, or it is just an idle tale. If once it could be shown that the least portion of heat or anything else came from nowhere, was made out of nothing, everything we believe about the nature of the universe would have to be given up, and there would be nothing with which to replace it.

But we may forget those foolish people, whose only desire was to injure science, and who, like all who fight against truth, only injure themselves; and we must now ask: Where does this heat come from?—knowing that it must come from somewhere. Here there were great differences of opinion until more knowledge was obtained.

THE GREAT RADIUM MYSTERY THAT MEN TRIED TO SOLVE

One very great man thought, and many thought with him, that radium was able to get from the air—all the atoms of which are always dancing about—some of the power which that dancing about contains; and then they thought that the radium somehow transformed this energy obtained from the air into the heat which it gives out. But that theory, and also various other theories, which looked upon the radium as a transformer, pick-

ing up rays or waves or motion or something from outside, and turning the energy of them into heat, have all been completely disproved.

A DISCOVERY THAT HAS TRANSFORMED OUR IDEAS OF HEAT

It has now been proved that the radium finds the source of its heat in itself; the heat comes from the breaking down of the atoms of the radium, and these atoms are slowly being broken up into other kinds of atoms which contain less energy, as part of the energy inside the radium atoms themselves was given off in the form of heat when they broke down. This discovery of a source of heat inside atoms was utterly unsuspected by anybody until a few years ago, and is one of the discoveries which mark a new stage in the history of knowledge.

Few who study the subject can doubt that the time will come—and that not remotely, though perhaps not for hundreds of years—when mankind will be able to tap, so to speak, this energy inside the atom, and use it as a source of heat to keep him warm, to drive his ships, and to do work of every kind.

Before we go on to the question of the work done by heat, there is yet one more case of heat radiation, which is of very great importance, to those who live on islands or peninsulas, and which we ought to have in our minds as part of this subject. The facts of heat radiation, as they bear upon the sea, daily affect the lives of all of us who live on any island set in the silver sea. When men study climates in general, they find that there are, on the whole, two great classes of climate—the climate found in the heart of a continent, and the kind of climate found in islands. These are called by men of science continental climates and insular climates.

WHY THE SEASONS CHANGE SO GRADUALLY IN THE BRITISH ISLES

The English climate is insular, and, like all other insular climates, owes its special features to the presence of the water round the land. The chief marks of an insular climate, such as theirs, are, that it is a rather moist climate, and that the differences between the seasons are small and gradual compared with what we find in the case of our continental climate. The one word *equable* describes this kind of climate in which summer is not too hot, winter is not too cold, and the changes from one season to another are not too violent.

Though the English always complain about the weather, they enjoy, in fact, perhaps the best example in the world of an insular climate, with all its great and many advantages for life of many kinds, and, above all, for human life. Britain would not have been Britain, and their forefathers would not have done what they have done for themselves and for us and for the world, were it not for the climate which so greatly favors the nurture of human life, and its best activities of every kind.

All this the islanders owe to the water which makes their land an island—to

> The silver sea
> Which serves it in the office of a wall,
> Or as a moat defensive to a house,
> Against the envy of less happier lands.

WHAT THEY OWE TO THE WATER THAT SURROUNDS THE ISLANDS

An insular climate owes its virtues to the behavior of water shone upon by the summer sun. As we have seen, a great fact about water is that it is opaque to heat radiations, will not let them pass through, and by absorbing them becomes heated itself. That is what the sea does. As we shall learn, water can take in an enormous amount of heat with ease. This it does not only by absorbing radiations from the sun, but by conduction of heat from the air which is above it.

All through the summer the sea is growing warmer, partly by absorbing the radiations which strike it directly from the sun, and partly by the passage of heat into it from the air. This means that the air is cooled, and, being cooled, flows inwards over the land beneath the hotter air which is not yet cooled, as we have already learned it must.

Thus they owe to the sea their mild summer—how mild, they have no idea until they try to spend a summer in a climate that is not so kind as their own. What it amounts to is this: that in the summer there is too much heat, and the sea steadily takes up the excess, so that they do not suffer. That is very far from being all. Nothing is lost. The radiations which the sea absorbed

in the summer, and the other kind of heat conducted to it from the air above it, must all be accounted for. The first result is that the sea gets warmer and warmer through the summer.

WHY THE SEA IS HOTTEST WHEN THE SUN HAS LOST ITS GREATEST POWER

Everyone who bathes in the sea—and everyone should do so when he gets the chance—knows very well that the sea is not at its hottest on Midsummer Day, but several weeks later. It is not the third week in June that long-distance swimmers choose for their attempts, but the end of July and August, or even the beginning of September, long after the sun has lost its greatest power.

It was in August, 1875, that Captain Webb swam from Dover to Calais. For nearly twenty-two hours he was cleaving his way through the sea. In the end he felt the sands of Calais beneath his feet and staggered up the beach. Not until 1911 did any other man succeed in swimming across the English Channel. It is doubtful if any man could remain in the water for so long in May or June. The water is then too cold.

The sea gradually becomes warmer after Midsummer Day, and all the time it is making the summer bearable. But as the autumn advances, and winter begins to come, the sun greatly loses its power, and the laws of heat begin to work in another way. Heat must flow from the hotter to the colder—whichever be hotter and whichever be colder—and just as it had to flow from the air to the sea when the air was the hotter, so it must flow from the sea to the air when the sea is the hotter.

So all through the winter, but especially during the earlier half of the winter, the sea is pouring back to the air the heat which it stored up during the summer. The sea becomes very cold, as we find if we try to bathe in it, say, in the month of February; but the air is warmed, and so, just as summer was not too hot, winter is not too cold.

HOW THE CLIMATE OF BRITAIN DEPENDS UPON THE LAWS OF HEAT

Thus, the great features of British climate, with all that this means for the health and success of human life, and for the work of Britain for the world, depend upon the laws of the traveling of heat, especially upon the peculiar properties of water in absorbing heat radiations, and in being able to store almost any amount of heat. What it means to be surrounded at no very great distance by water, which absorbs radiant heat, we can best understand if we see what happens in other parts of the world where the state of things is different. Let us suppose, for the sake of the argument, that Britain remained just as it is, but that instead of the water around it there were put an extensive bank of dry sand.

Not many of us know from experience what the desert is, and what it means to live where the surface of the earth, instead of absorbing the sun's radiations, throws them all back to the air. If such a change were made around Britain, the whole face of the country would, in a short time, be utterly changed. The Britain of to-day would cease to exist, and a new country that no one could recognize would take its place. The summer would be intolerably hot, owing to the reflection of heat radiations from the desert sand, and owing to the fact that there was nothing to catch away and store up any of the radiant heat from the sun.

WHY THEY SHOULD NOT COMPLAIN OF THE COOLING AND REFRESHING RAIN

The British complain of the rain in the summer, but they may be thankful that they must not live through a rainless summer, merciless and shriveled, such as they would endure if they had sand instead of sea around them. On the other hand, when the winter came, there would be no rich stores of heat to be given up, so as to compensate for the lack of heat from the sun. Britain would cease to be Britain, and would disappear in a year or two with the disappearance of that climate which the British always abuse, but upon which their happiness and success as a nation depend.

So they owe more to the sea even than Shakespeare, and the British poets who have sung the sea since his time, remembered to tell, and perhaps now our British readers may even try to grumble a little less about the weather, and that will, at any rate, be something that they will have gained.

THE NEXT PART OF THIS IS ON PAGE 4389.

A GREAT ROMANCE OF ADVENTURE

ALEXANDER DUMAS, the celebrated romancer, who was largely inspired in his work by the example of the great Sir Walter Scott, based most of his famous stories on episodes from history, although he took great liberties with historical facts, and considered that the purposes of his tale were more important than the facts of history. Yet the greatest of his novels is one in which history plays practically no part at all. "The Count of Monte Cristo" is purely an effort of the imagination, and a more fascinating story was never conceived in the mind of a romancer. In its original form it is a work of enormous length, and takes one a great deal of time to read, though the time so spent is full of delight. Here we have endeavored to retell the story very briefly, but even so it will require twice the space of any of the others. Only the first part of the story is printed here; the second part begins on page 4431. "Monte Cristo" was originally published in 1844.

THE COUNT OF MONTE CRISTO

CONTINUED FROM 4228

THE three-masted ship Pharaon arrived at Marseilles from Smyrna, commanded by the mate, young Edmond Dantès, for the captain had died on the voyage. Edmond was a great favorite with the crew, to whom he was more like a brother than a superior officer, and his skill in seamanship was so unquestioned that the shipowner did not hesitate to offer him the command. A captain at nineteen, his increase of pay would enable him to make his old father comfortable, and it would also enable him to marry at once the dark-eyed Mercédès, who had been his sweetheart for three years.

Little wonder, when he had set foot in Marseilles, there was not a happier man in all the city. He seemed to walk on air. His wedding was arranged, and the guests invited to the feast. Everything was prospering so much with him that more than once he said his happiness was almost too great to last.

Edmond Dantès, being naturally of a frank and friendly disposition, never suspected he could have enemies. But what he innocently considered his good luck was the means of creating enemies against him. The supercargo of the Pharaon was an envious fellow named Danglars, who would have liked to command the vessel, so that he might profit dishonestly out of its trading. Fernand, the half-Spanish cousin of Mercédès, was deeply in love with the beautiful girl, and hated Edmond because he had won her heart. Here, indeed, were enemies enough if the young sailor had suspected them for one moment. But he counted these two among his friends.

It was a time of great political unrest. Napoleon, who had been lord of well-nigh all Europe, had surrendered his throne, and in the little island of Elba, which lies between his native Corsica and the coast of Italy, was plotting how he might regain his lost sceptre and revive his empire. The French throne was now occupied by Louis XVIII., the younger brother of Louis XVI., who had been beheaded during the Revolution in 1793. But the country was not satisfied with his rule, and, of course, the old veterans who had fought in the great wars of Napoleon, and all who were devoted to the idea of a great French empire, longed to see Napoleon back again.

All that was necessary to have a man cast into prison at that time was to denounce him to the public prosecutor as taking part in some plot to restore "the usurper," as Napoleon was named by the supporters of King Louis XVIII. Edmond Dantès had quite innocently come under the suspicion of being in treaty with Napoleon's grand marshal at Elba, for, in obedience to the last instruction of his dead captain, Edmond,

on his way home from Smyrna, visited the island of Elba, and, going ashore alone, received from the grand marshal an important letter, which he was charged to deliver personally to a gentleman in Paris.

Edmond was to hasten his wedding, and after the ceremony to set out upon a trip to Paris, during which he would make safe delivery of this letter.

HOW HIS ENEMIES PLOTTED AGAINST CAPTAIN EDMOND DANTÈS

But meanwhile Fernand's jealousy had taken such possession of his mind that his one wish was to get Edmond removed before he could marry Mercédès. In Danglars he found a willing conspirator, who saw how Edmond's visit to Elba could at least be used to have him arrested and put under examination. Caderousse, a tailor, was at first taken into the confidence of the conspirators, but, as he began to think it was a dangerous trick to play on the young captain, he advized the others against it.

While seeming to agree, the other two went forward with their secret denunciation of Edmond; and Danglars, who was present at the wedding festival, from which Fernand in great excitement had hastened away, had the wicked satisfaction of seeing poor Edmond arrested by a magistrate and marched off to the town-hall, when he was on the point of leaving the wedding feast to proceed to church with Mercédès for the religious ceremony.

THE LETTER THAT BROUGHT ILL-FORTUNE TO THE YOUNG SAILOR

The consternation among all the friends of young Dantès was almost stupefying. Knowing that he was too young to know much of politics, too frank and manly to be engaged in any secret scheme, too honest to be a smuggler, they were all at their wits' end to guess why he had been arrested.

His employer, Monsieur Morrel, who believed in him absolutely and was willing to take any personal pledge for his honesty, tried to comfort Edmond's old father and Mercédès by saying it must be some terrible mistake, and that son and bridegroom would soon be restored to them.

Edmond, when brought before M. de Villefort, the deputy public prosecutor, to be questioned in his private room, was utterly bewildered at what had happened, and the prosecutor could see quite clearly the transparent honesty and innocence of his prisoner. So sure was he that Edmond was not only innocent, but ignorant of all political feeling, that he fully intended to dismiss him, until his inquiries elicited the fact that the prisoner had been found in possession of a letter from Napoleon's grand marshal at Elba addressed to a gentleman in Paris. He looked among the articles taken from Edmond, and found the letter. It was addressed to one Noirtier; and on reading the name and address the whole appearance of Villefort underwent a sudden and terrible change.

Keenly and anxiously he now questioned Edmond as to what he knew of the letter, and was satisfied that the young man knew nothing beyond the name and address of the person to whom he had engaged to deliver it.

THE DOOM OF DANTÈS IS PRONOUNCED BY THE PUBLIC PROSECUTOR

Villefort opened and read the letter with further show of excited attention, and then, calling Edmond to witness that he burned it to ashes in the grate, he made him swear never to mention the name of the person to whom it was addressed. The public prosecutor was actually appealing to his prisoner!

Little did Edmond know the terrible struggle that went on in the bosom of the public prosecutor, who recognized the undoubted innocence of the prisoner but was tempted to safeguard his own private interests, which the prisoner might by an innocent word betray. For this Monsieur Noirtier, to whom the letter in Edmond's possession had been addressed, was none other than Noirtier de Villefort, father of Villefort. He was an ardent supporter of Napoleon, whereas his son was scheming for favor at the hands of the restored monarchy. The public prosecutor had found his father's Napoleonic sympathies so great a drawback to him that he had altered his name to avoid being associated with that of Noirtier.

The letter which Edmond had brought from Elba was to inform Noirtier that Napoleon in a few days would make another bid for the crown, and, landing in France, would summon his old legions to his banner. Villefort thought he saw in this knowledge a means of

advancing himself with the Government; but the fact that he had obtained information from a letter addressed to his own father would mean death to his father and be fatal to his own prospects if it should become known. None but Dantès knew of the letter. With him safely imprisoned, Villefort's course would be free. Thus was the doom of Edmond Dantès cast, and he was sentenced to imprisonment.

As we know from history, Napoleon landed, and made his last heroic stand, during the period called "The Hundred Days," which ended with his final overthrow at Waterloo. Monsieur Morrel, who was a supporter of the emperor, urged upon Villefort, when it seemed that Napoleon must again establish himself, to draw up a petition in favor of Dantès, begging his release on the ground of services rendered in Napoleon's cause, since it was on that ground he had been imprisoned under Louis XVIII., who had now fled from France.

THE INNOCENT YOUNG PRISONER IN THE TERRIBLE CHÂTEAU D'IF

Villefort willingly made the petition as strong as possible in favor of Dantès, dwelling on imaginary services in the Napoleonic cause, but did nothing with it beyond preserving it carefully among the documents in the town-hall, expecting that it would be a terrible weapon against Dantès when, as was not improbable, and as history records, Louis XVIII. came back to the throne.

The deputy public prosecutor had decided in favor of safeguarding his own interests even at the expense of dooming to a terrible imprisonment an innocent young man.

Poor Edmond was removed from the town prison and taken under a strong guard in a boat to the gloomy island fortress of Château d'If, a prison in the sea, whence no one had ever been known to escape.

A sullen and dirty-looking under-gaoler conducted him to a damp and dismal room almost underground, where a lamp flickered on a stool, some fresh straw had been laid down for a bed, and a jug of water and a piece of coarse bread provided for refreshment.

As soon as the unhappy young man had passed within the door the gaoler took up the lamp, and, with a surly "Good-night," bolted in his bewildered prisoner. Dantès was alone in darkness and in silence, cold as the shadows that seemed to breathe on his burning forehead. At dawn the gaoler found him standing as he had left him, his eyes swollen with weeping. All his senses were numbed. The gaoler had to touch him before he realized his presence.

SIX YEARS WITHOUT HOPE IN A DARK AND NOISOME DUNGEON

He could not eat the food the man brought, and when at length his awful situation dawned upon his mind, he threw himself in despair on the floor, crying out bitterly against the inscrutable fate that had worked him such woe.

Some days passed and he had occasional words with the gaoler, demanding always to see the governor, which he was told was impossible, and finally saying he would kill the gaoler if he would not promise to let Mercédès know what had become of him.

The result of this threat of violence was that the prisoner was consigned to one of the dungeons of the castle, darker and damper than the room he had first occupied, and even more lacking in all means of escape.

So the days passed, the weeks grew into months, and the months went by without the prisoner having counted them. He had languished in his dungeon for well-nigh six years when he began seriously to think of how he might starve himself to death. He had refused all food for four days, and was growing very weak, when, about nine o'clock at night, he suddenly heard a hollow sound in the wall against which he was lying. It was like the continual scratching of a huge claw, a powerful tooth, or some metal instrument scraping against stone.

THE STRANGE SOUND THAT AWAKENED HOPE IN THE PRISONER'S HEART

Weak and exhausted as he was, he feared his brain might be deceiving him, but by careful listening he decided the noise was made by someone scraping against the stones of his dungeon wall. Wild thoughts of liberty leaped up within him. The noise was going on again when the gaoler brought his breakfast next morning, and, fearful lest the gaoler should hear it, Edmond became suddenly very talkative, so that the man thought him delirious, and brought

him some broth and white bread. His recent decision to starve to death was now suddenly abandoned. He greedily drank the broth to revive his strength for what might be required of him. He loosened a stone from the wall and struck three times with it against the wall whence the sound seemed to come.

THE UNKNOWN PRISONER MINING THROUGH THE CASTLE WALL

At the first blow the sound ceased, as if by magic. It was not heard again that day, and the night passed in silence also, so that he determined it was some prisoner cutting his way through to liberty.

All his anxiety now was to recover his strength. He no longer refused the food brought to him. The same sounds did not occur again, but after three days he felt certain the unknown prisoner was again at work, using a lever to move the stones instead of a chisel. Edmond determined that he, too, would try to cut a passage out, and perhaps join up with the other.

The only thing he could think of was to break his water-jug and conceal two or three of the fragments in his bed. With a piece of the broken jug he scraped away all night, removing the damp mortar around a large stone in the wall which was hidden when his bed was drawn against it. He seemed to make but little progress, but all night long he heard the subterranean workman continuing to mine his way.

In the morning the gaoler grumbled at the broken jug and fetched in another. After he had gone, it was with a new delight that the prisoner resumed the scraping away of the mortar.

DANTÈS CONTINUES HIS DESPERATE EFFORT TO GAIN HIS LIBERTY

He reproached himself for not having occupied himself in this way for years. He had now been six years in his dungeon, and what might he have done in that time had he not given way to utter despair ?

In three days he had removed all the cement from the stone, but the stone itself he could not move without some sort of lever. His ingenuity, so long disused, suddenly became active again. He had noticed that his gaoler brought his soup in an iron saucepan with a strong handle, and for this he would now have given ten years of his life. How to get the saucepan with its handle to use as a lever for moving the stone was the next object of his thoughts. This he achieved by leaving his soup-plate on the floor, so that when the gaoler next came in he stepped upon it and broke it. The man had thus either to go upstairs again for another plate or to leave the pan containing the soup with the prisoner, and bring a new plate at his next visit. Happily, his natural laziness prompted him to leave the saucepan, and thus Dantès came into possession of the priceless instrument. Using its handle and toiling away all night, he made wonderful progress in loosening the stones of the wall. And as the gaoler forgot to bring him a new plate, still letting the saucepan serve the purpose of a plate, the prisoner had much longer use of it than he had dared to hope.

THE VOICE IN THE WALL AND WHAT IT SAID TO EDMOND DANTÈS

For the last three days he had heard no sound of the unknown toiler. But this was all the more reason why he should himself press on with his own work.

Day and night he toiled incessantly. The saucepan, of course, was carefully replaced, and its handle straightened before the gaoler appeared, so that he might suspect nothing.

But Dantès had burrowed no great distance into the wall when he came upon a mighty beam of wood which presented a dead end to the hole he had made. It would now be necessary for him to dig above or below it. The thought of such a task dismayed him. In his agony of mind he murmured aloud, beseeching God not to let him die in his despair.

" Who talks of God and despair at the same time ? " said a voice that seemed to come from beneath the earth, and, deadened by the distance, sounded hollow and sepulchral in the young man's ears. Edmond's hair stood on end, and he rose on his knees.

" In the name of heaven," cried Dantès, " speak again, though the sound of your voice terrifies me ! "

" Who are you ? " said the voice.

" Edmond Dantès," replied Dantès, who made no hesitation in answering. " A French sailor."

" How long have you been here ? "

"Since the 28th of February, 1815."

"Of what are you accused?"

"Of having conspired to aid the emperor's return."

"How for the emperor's return? The emperor is no longer on the throne, then?"

"He abdicated at Fontainebleau, in 1814, and was sent to the island of Elba. But how long have you been here, that you are ignorant of all this?"

"Since 1811."

Dantès shuddered: this man had been four years longer than himself in that dreadful prison.

This strange conversation was continued much further, and Edmond gathered that only a few stones had now to be removed to join the tunnel of the other prisoner to the much smaller hole that he had made. The other tunnel was lower and came under the beam that had caused Edmond to despair. But, alas! the heroic labors of the unknown worker had been in vain.

With incredible toil he had been making his passage through the wall for years, and had burrowed a tunnel fifty feet in length, only to find that instead of leading, as he had hoped, to the outer wall of the castle, whence he would have flung himself into the sea, it led to the cell of another prisoner.

THE MEETING OF THE TWO PRISONERS AND THEIR NEW COMPANIONSHIP

Next day the other prisoner came back along his tunnel and made his way into Edmond's cell. They greeted each other with joy. For, at the worst, if they could continue to meet each other daily, some little of the bitterness of their captivity would be removed by their companionship. Edmond's new friend was a man who might have been sixty years of age. Though small of stature and very thin of face, with a long black beard, and hair that seemed to have been whitened by sorrow and suffering rather than age, he still showed considerable activity for one who had been so long imprisoned. His bright and active mind, and the healthy influence of the long task he had just finished, had helped to keep him in fit condition.

He told Dantès about the marvelous tools he had been able to make out of the scantiest material; how he had made his chisel from one of the clamps of his bedstead, and with this chisel had been able to cut the long tunnel in the wall. He examined Edmond's cell carefully, and, climbing up by the help of Dantès to the loophole near the ceiling, he found that it looked upon a courtyard where sentries were on duty, thus cutting off all hope of escape.

"Then the will of God be done!" said the old man slowly; and an air of profound resignation spread over his careworn countenance. He then told Dantès that he was the Abbé Faria.

THE STRANGE STORY OF THE ABBÉ FARIA AND HIS LONG ENDURANCE

Previous to being transferred to the Château d'If, in 1811, he had suffered three years' imprisonment in another fortress. His crime had been to advocate a united Italy and to scheme for the making of a powerful kingdom out of the petty principalities into which his native land was divided at that time. This was treason to Napoleon's plans in 1807, and the abbé had been betrayed to the French.

Edmond's new friend was none other than the "Mad Abbé," though he showed no signs of madness and many of wisdom far beyond the ordinary man. Dantès was fascinated beyond expression by the abbé's account of his prison occupation, and asked him why he should not begin again, with him to help, to cut a passage which would lead them to the outer walls.

"In the first place," said the abbé, "I was four years making the tools I possess, and have been two years scraping and digging out earth, hard as granite itself; then what toil and fatigue has it not been to remove huge stones I should once have deemed impossible to loosen.

HOW THE ABBÉ HAD CUT HIS TUNNEL THROUGH THE CASTLE WALL

"Then, to conceal the mass of earth and rubbish I dug up, I was compelled to break through a staircase, and throw the fruits of my labor into the hollow parts of it; but the well is now so completely choked up that I scarcely think it would be possible to add another handful of dust without leading to discovery. And just at the moment when I reckoned upon success, my hopes are for ever dashed from me. No, nothing shall induce me to renew attempts evidently at variance with the Almighty's pleasure."

Thus it was willed, and, as all hope

of escape was finally abandoned, the two prisoners sought by every means in their power to hide the evidence of their daily intercourse. It was now the abbé's pleasure to pass much of the time by instructing Edmond in those branches of knowledge in which he himself was skilled.

DANTÈS BECOMES THE EAGER PUPIL OF THE "MAD ABBÉ"

Edmond proved an apt pupil, and those long hours spent by the one in giving, and the other in receiving, knowledge of philosophy, history, science and languages brought to the lives of both a melancholy pleasure, which dulled the keen edge of their sorrow.

The abbé, by studying Edmond's case, was able to show to him that the enemy who had caused his imprisonment in the Château d'If could be none other than Villefort, in whom he had been greatly deceived. His own history the abbé related at length to his younger companion, and eventually, when his strength gave evidence of failing and a stroke of paralysis disabled one of his arms, he let Edmond into his great secret. It was this secret that had won him the title of the "Mad Abbé."

Before he had been arrested, the abbé had been secretary to the Count of Spada, the last of a famous race of Italian noblemen, who had died on December 25, 1807. It had come to the knowledge of the abbé during his association with the count that one of the Spadas of the fifteenth century, who was a cardinal, was poisoned, together with his nephew, by the agents of Cæsar Borgia, so that his immense fortune might come into the possession of the Pope and his friends.

But an extremely careful study of the history of all the famous people in Rome connected in any way with the

"THE SEA IS THE CEMETERY OF THE CHÂTEAU D'IF"

The most thrilling part of "Monte Cristo" is the story of Dantès' escape after fourteen years' imprisonment. Another prisoner had scraped a tunnel through the wall, only to find himself in the cell of Dantès. When the elder prisoner died, the gaolers put his body in a sack to throw it in the sea. But, creeping into the cell of his dead friend, Dantès removed the body and sewed himself in the sack. Thus he was thrown into the sea, and, ripping the sack up with his knife, he succeeded in swimming to a vessel, and so escaped.

Spadas of that time had proved to the Abbé Faria that no one seemed to have benefited by the deaths of Cardinal Spada and his nephew. The abbé judged from this that the cardinal had hidden his fabulous riches somewhere to prevent their falling into the hands of his enemies at Rome, and had arranged to let his nephew into his secret, but no one else.

For years had Faria searched among the documents of the Spada family in the hope of finding something in the nature of a will, but discovered nothing. At the death of his patron, the count, he inherited the library of that nobleman, with its famous mediæval breviary, or prayer-book, which had been one of the treasures of the Spadas. One night, requiring a light hastily, he groped about in the darkness for the breviary, recollecting an old piece of paper, brown with age, which had been used as a marker in it, probably for centuries. He considered this of no value, as it bore no writing, and put the end of it into the fire to light it. But, to his amazement, as it burst into flame he saw yellowish handwriting begin to appear upon it.

THE BURIED TREASURE IN THE ISLAND OF MONTE CRISTO

Immediately he extinguished the flame, though not before a considerable part of the paper had been destroyed. In great excitement he lighted his taper in the fire itself, and then examining the paper found that the action of the heat had brought out some writing traced originally in an ink which only became visible when held to the fire. This is what he read:

This 25th day of April, 1498, be . . .
Alexander VI. and fearing that not . . .
he may desire to become my heir, and re . . .
and Bentivoglio, who were poisoned . . .
my sole heir, that I have bu . . .
and has visited with me, that is in . . .
island of Monte Cristo all I poss . . .
jewels, diamonds, gems, that I alone . . .
may amount to nearly two mil . . .
will find on raising the twentieth ro . . .
creek to the east in a right line. Two open . . .
in these caves; the treasure is in the furthest a.
which treasure I bequeath and leave en . . .
as my sole heir.
25th April, 1498. CÆS . . .

Being thrust into prison soon after this discovery, the Abbé Faria had given almost endless study to the task of completing the unfinished lines. After many years his efforts had been rewarded with success. He had satisfied himself that the portion of the paper which was burned away had read thus:

. . . ing invited to dine by his Holiness
. . . content with making me pay for my hat
. . . serves for me the fate of Cardinals Caprara
. . . I declare to my nephew Guido Spada
. . . ried in a place he knows
. . . the caves of the small
. . . essed of ingots, gold, money,
. . . know of the existence of this treasure, which
. . . lions of Roman crowns, and which he
. . . ck from the small
. . . ings have been made
. . . ngle in the second;
. . . tire to him
. . . AR SPADA.

The abbé explained at great length, and with much excitement, how he had come to solve the mystery of the burned paper, and his solution proved that on the island of Monte Cristo treasure valued at something like thirteen millions of money awaited the lucky person who knew where to find it.

THE DEATH OF THE ABBÉ FARIA AND WHAT IT LED DANTÈS TO ACHIEVE

Dantès knew the island, which lies between Corsica and Elba. Indeed, he had once touched at it. It is a rock of almost conical form, probably thrown up originally in some volcanic disturbance. Dantès traced a plan of it, and the abbé gave him advice as to how he thought the treasure might be recovered. For poor Faria had now abandoned all hope of ever being free himself to search for the treasure of Monte Cristo. Since his paralytic seizure he feared his end was near, and wished that Dantès might know his secret in case he succeeded in escaping from the prison. It was not long, indeed, before the poor abbé died. Edmond was plunged into a new agony of mind at the loss of his friend, who had been more than life to him, and at the hopelessness of the future.

HOW THE TUNNEL IN THE WALL SERVED A GREAT PURPOSE

But his wits had sharpened in his years of intercourse with the marvelous man who had breathed his last in that terrible prison. He was no longer the simple-minded mate of the Pharaon, but a man of much learning, immense resource, and now rendered bold by his desperate situation.

Thanks to the tunnel between the two cells, Dantès was able to listen to all that passed in the cell of the dead abbé.

He gathered that there would be no ceremonies about the funeral, and that the body would be buried after sunset. When the doctor had certified that the abbé was dead, the gaolers brought a large sack, in which the body, divested of its clothing, was placed, and so left in the cell. Dantès now determined to make his great stroke for liberty. Just as the abbé in life had saved and succored him, so was he in death to provide the way of escape.

DANTÈS CONCEIVES A WONDERFUL AND DARING PLAN OF ESCAPE

Opening the sack, Edmond took out the dead body of his friend, and with slow and painful effort contrived to drag it through the tunnel to his own cell. Placing it in his own bed, with the face to the wall, he covered it with the rags he wore himself, so that when the gaoler came with his evening meal he might suppose the form in the bed to be Dantès asleep, as he often found him so. Edmond's next move was to take the place of the corpse in the sack, sewing himself in with the needle which had been one of the abbé's most ingenious tools. In his hand he held the dead man's knife, and with palpitating heart awaited events.

Slowly the hours dragged on, until at length he heard the heavy footsteps of the gaolers descending to the cell. With rude jokes about the "Mad Abbé," they lifted the sack, after some talk about "tying the knot," which puzzled Edmond at the time. He was placed on a bier, carried by two men, and after some further movements, which he did not understand, the party went forward, lighted by a man with a torch, through the castle passages, until they came to a door which was opened. As they passed through this, the noise of the waves were heard as they dashed on the rocks below.

HOW THE PRISONER GOT CLEAR OF THE TERRIBLE CHÂTEAU D'IF

They ascended five or six more steps, and then Dantès felt that they took him, one by the head and the other by the heels, and swung him to and fro. "One," said the turnkeys, "two, three, and away!" And at the same instant Dantès felt himself flung into the air like a wounded bird falling, falling with a rapidity that made his blood curdle. At last, with a terrific dash, he entered the ice-cold water, and as he did so he uttered a shrill cry, stifled in a moment by his immersion beneath the waves. Dantès had been flung into the sea, into whose depths he was dragged by a thirty-six-pound shot tied to his feet. The sea is the cemetery of Château d'If.

Dantès, although giddy, and almost suffocated, had yet sufficient presence of mind to hold his breath; and as his right hand held his knife, he rapidly ripped up the sack, extricated his arm, and then his body. But in spite of all his efforts to free himself from the bullet, he felt it dragging him down still lower. He then bent his body, and by a desperate effort severed the cord that bound his legs at the moment that he was suffocating. With a vigorous spring he rose to the surface of the sea, while the shot bore to its depths the sack that had so nearly become his shroud.

Dantès merely paused to breathe, and then dived again in order to avoid being seen. When he rose again, he was fifty paces from where he had first sunk.

DANTÈS FINDS THE TREASURE IN THE CAVE AND BEGINS HIS VENGEANCE

He then struck boldly out to sea, which was rising in a tempest of wind, and, fortunately, was picked up by a sailing vessel, to whose captain he explained that he was the only one saved from the crew of a Maltese boat that had foundered, and accounted for his long hair and beard by an ingenious story about a vow which had now expired. He learned that it was the 28th of February of the year 1829, so that it was fourteen years, day for day, since his arrest. He wondered what had become of Mercédès, who must believe him dead. Then his eyes lighted up with hatred as he thought of the three men who had caused him so long and wretched a captivity.

Now at liberty, and safe on board the sailing vessel bound for Leghorn, he renewed an oath of implacable vengeance against Danglars, Fernand, and Villefort. It was not long before he had discovered the secret cave in the island of Monte Cristo, with all its dazzling wealth, as the Abbé Faria had truly foretold. He now stood possessed of such means of vengeance as never in his wildest dreams had any innocent prisoner hoped to be able to command.

THE SECOND PART OF THE STORY OF "MONTE CRISTO" BEGINS ON PAGE 4431.

WHAT THIS STORY TELLS US

A COUNTRY is judged on the whole by the men who have been chosen by the people to guide its destinies. Elsewhere in the book we have told you of Canada as a Nation, and the growth of the people. This story tells you something of the men who guided the nation in its youth and wisely helped its growth. Canadians have said, with pride, that they were the first people to show the world that a country could become a nation without bloodshed. Some of the men whose stories are told here are among those who wove the bands that drew the people into a nation within the empire to which they are proud to belong. The methods of these well known men were not all the same, but they are all alike in love of their country and in using all their powers.

A FEW WELL-KNOWN CANADIANS

CONTINUED FROM 4131

THROUGH more than three centuries of conflict and doubt, the history of Canada has gradually unfolded itself until to-day we have a nation. The daring of the early pioneers in war and in trade; the courage of the Roman Catholic missionaries; the Frenchmen's loyalty to creed, race and language; the love of liberty of the United Empire Loyalists; these and many other influences have gone to mold Canadian institutions and Canadian character.

SOME OF THE FATHERS OF THE CONFEDERATION

The men who drew together all these complicated threads into a united whole, and held it true to British loyalty, while retaining an independence of its own, are known in Canadian history as the Fathers of the Confederation. They were a band of men who were drawn together by a great idea. George Brown, a native of Scotland, who had made Canada his adopted home, was a brilliant orator and newspaper writer, who was already well known, and exercised great influence through the Toronto Globe, of which he was the founder. Sir George Etienne Cartier, a French Canadian lawyer, used his persuasive powers in bringing Quebec into the union. He was made a knight for his services to the empire. Sir Oliver Mowat was already a judge, and afterward was successively Premier of his native Ontario for twenty-four years, a member of the Senate, and lieutenant-governor of the province he had served so faithfully and well. Sir Charles Tupper commenced life as a physician, and practised his profession for over ten years before he went into politics. Seeing the need for some sort of unity, he was trying to draw the Maritime Provinces together at the very time that delegates from Ontario and Quebec were sent down to invite them to the conference at Quebec, and was instrumental in bringing Nova Scotia into the Confederation. He held important offices in the Cabinet, and in 1884 was made Lord High Commissioner for Canada in London. In 1896 he was Premier for a few months, but was defeated by the Liberal party, and after five years gave up all share in public life. He was, however, made a member of the Imperial Privy Council in 1908. He died in England in 1915 at the age of ninety-four. Other men, like Sir Samuel Tilly and Sir Alexander Galt, did much for the cause of Confederation. All did their work well and truly, but the man who carried the greater part of the burden, and who

did more than all to hold the nation together, after it had been united, was John Alexander Macdonald.

THE RT. HON. SIR JOHN A. MACDONALD, K. C. B.

John A. Macdonald was born at Glasgow on January 11, 1815. His father, Hugh Macdonald, was a native of Sutherlandshire, but while a young man moved to Glasgow. Having failed in business, he migrated in 1820 to Canada and settled in the town of Kingston, Ontario. The father still did not succeed, and moved in succession to two of the small neighboring settlements, Hay Bay and Stone Mills on the Bay of Quinté. In 1836, the family returned to Kingston, where the father was appointed to a position in the Commercial Bank.

The lad between the age of ten and fifteen attended the Kingston Grammar School. This concluded his school days. "I had no boyhood," he once said to a friend. "From the age of fifteen I began to earn my own living."

On leaving school in 1830, he commenced the study of law in the office of Mr. George Mackenzie. On February 6, 1836, he was called to the bar, immediately opened an office in Kingston, and soon had a good practice.

In the municipal elections of 1843 he was elected alderman, and the same year married his cousin, Miss Isabella Clark. Soon after their marriage Mrs. Macdonald became a confirmed invalid, and until her death in 1858, he was most devoted in his care of her.

In 1844, he was elected to the legislative assembly. For the first few sessions, he took little active part in the discussions of the legislature. He spent his time in making himself familiar with parliamentary forms and in a study of constitutional history. The studious young member soon attracted attention. In May, 1847, he was appointed receiver-general, but a little later the ministry resigned. In the Coalition Ministry of 1854, he was chosen attorney-general, and three years later became Premier of the Province of Canada.

Macdonald was the guiding spirit of the Quebec conference which met in 1864 to discuss confederation. He was chairman of the committee that went to London to arrange the details of the British North America Act, and for his services he was made a Knight Commander of the Bath. While in London he married Miss Bernard, daughter of Thomas Bernard of Jamaica.

After confederation, Sir John was chosen to form a ministry and became the first Premier of the Dominion of Canada. In 1873 he resigned, and in the elections which followed, his party was defeated. With his national policy and the cry of "Canada for the Canadians," he was returned to power in 1878 and remained at the head of the government until his death in 1891.

The election of 1891 was the last great effort of a long political career. The strain of the winter campaign with all its excitement was too much for the aged statesman. While attending a meeting at Napanee, Ontario, he took a chill from which he never recovered.

A wreath of white roses on his breast as he lay in his coffin, "From Her Majesty, Queen Victoria, in memory of her faithful and devoted servant," and a patent of nobility conferred upon his widow as the Baroness Macdonald of Earnscliffe, were marks of favor of his sovereign. A memorial service in Westminster Abbey, the first of its kind in honor of a colonist, and a tablet erected soon after his death in the crypt of St. Paul's Cathedral, indicated the sense of national loss felt in the motherland.

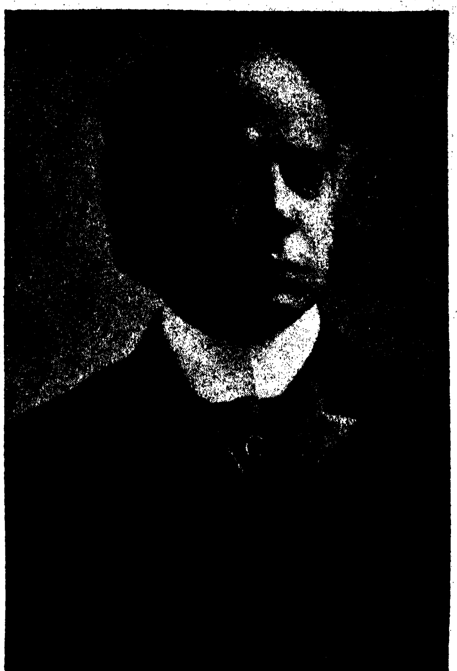
Sir John was not an orator. His aim was to carry his point and not to win applause. The plain common sense which stamped his views carried great weight with the people. His ambition was a closer union of the provinces and still closer ties with the motherland.

RT. HON. SIR WILFRID LAURIER, G. C. M. G.

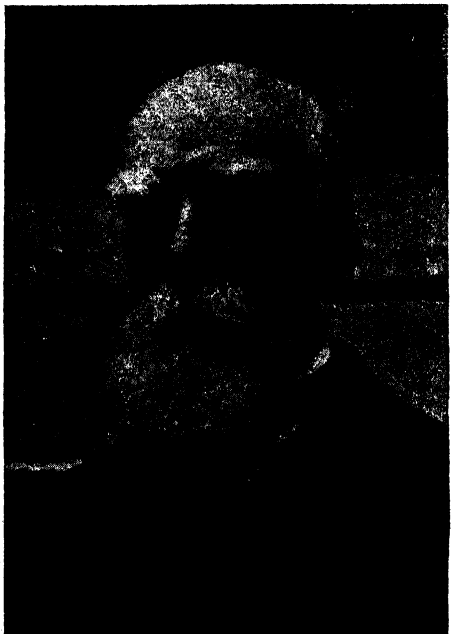
Wilfrid Laurier was born at St. Lin, Quebec, November 20, 1841. His father was a land surveyor. He was educated at L'Assomption College and at McGill University, where, in 1864, he graduated in law. The same year, he was called to the bar. Four years later he married Miss Lafontaine.

In 1871, Wilfrid Laurier was elected to the legislative assembly of Quebec. The morning after his maiden speech, his name was on every lip. Mr. Louis Frechette, the poet, wrote, "Whence has this new orator come? so fluent, cultivated and charming; who awed even his opponents into respect by language so polished, so elevated in tone, so courteous in

FOUR FAMOUS CANADIANS



These two Canadian statesmen have had much to do with the development of Canada. Sir John A. Macdonald gave his life to the welfare of his adopted country. Sir Wilfrid Laurier is a Canadian by birth and for sixteen years was the actual head of the government, as the Governor-General sent over from London has little real power. Since 1911 he has been leader of the Opposition.



Lord Strathcona, who died in 1914, aged ninety-four, was even then a strong and vigorous man and represented Canada in London as High Commissioner. Sir Gilbert Parker's novels of Canadian life have attracted attention wherever English is spoken. Though he now lives in England, his heart is still in Canada, and as a member of the British Parliament he can speak for his country.

rebuke and sarcasm and above all so moderate even in the heat of discussion." Henceforth he was known as the silver-tongued Laurier.

In 1874, he was elected to the House of Commons. His fame as an orator preceded him. The galleries were crowded to hear his first speech. He won such a triumph that he was marked for early appointment to the cabinet. In 1876 he was chosen minister of Inland Revenue. When Mr. Blake resigned the leadership of the Reform party in 1887, Laurier was chosen as his successor. On the defeat of the Conservatives in 1896, he became Premier and held office until the defeat of the Liberal party in 1911. He received the honor of knighthood in 1897.

Sir Wilfrid is tall, rather slender and has a figure most graceful and dignified. In his clean shaven face, dignity and goodness are blended. He loves his nationality and is proud of his French origin, but he is a great admirer of the English institutions.

RT. HON. SIR DONALD SMITH, LORD STRATHCONA AND MOUNT ROYAL

Donald Alexander Smith was born in Morayshire, Scotland, in 1820. He received a common school education and, in 1838, entered the service of the Hudson Bay Company. Many years were spent at trading posts on the coast of Labrador and in the Northwest. Promotion followed promotion until he became Governor of the Company.

He was elected to the first legislative assembly of Manitoba and served in that body for four years. For nearly a score of years, he was member of the House of Commons. In 1896 he was appointed High Commissioner for Canada in London.

Sir Donald took an active part in the building of the Canadian Pacific Railway, and its completion was largely due to his efforts. Indeed, if it had not been for the work of Sir Donald Smith, George Stephen and William C. Van Horne, the general manager of the road, the Canadian Pacific Railway could scarcely have been finished within the appointed time. His financial aid was always ready to promote Canadian interests. His interest in education was proved by gifts of large sums of money to McGill University, and the endowment of the Royal Victoria College, for women, in Montreal, which he built. With his friend, Lord Mountstephen, he endowed the Royal Victoria Hospital, in Montreal, and left a million dollars to it when he died.

His sovereign soon bestowed upon him many honors. In 1897, he was raised to the peerage as Lord Strathcona and Mount Royal. He also served as Chancellor of McGill and Aberdeen Universities. Nearly a score of colleges in Great Britain, the United States and Canada gladly conferred upon him honorary degrees. Until his death in 1914, in spite of his advanced age, this grand old man, hale and hearty, performed his duties as Canada's representative in London.

SIR GEORGE STEPHEN, B.T., G. C. V. O., LORD MOUNTSTEPHEN

George Stephen was born in 1829 in Banffshire and emigrated to Canada in 1850. He soon became interested in many business enterprises. He gave valuable assistance in building the Canadian Pacific Railway and was its president until 1888. In 1886 he was made a baronet and five years later raised to the peerage with the title of Lord Mountstephen.

SIR ROBERT LAIRD BORDEN

The present Prime Minister of the Dominion was born at Grand Pré, Nova Scotia, June 26, 1854. He received an academic education, studied law, and as he made himself an authority on maritime and constitutional law he quickly gained a large practice, and had important cases entrusted to him. In 1896 he entered Parliament and became so prominent that he was chosen leader of the Conservative Party, five years later, when Sir Charles Tupper resigned. When his party gained a majority in the elections of 1911, he succeeded Sir Wilfrid Laurier as Prime Minister of Canada, and was made a member of the Imperial Privy Council. At this time he proposed in Parliament that Canada should build three battleships to be added to the British Navy. A bill was passed by the House of Commons but rejected by the Senate, and the scheme fell through.

During the Great War, Sir Robert took an active part in imperial affairs, and made more than one visit to London. In 1917, largely through his influence, a conscription law was passed. It raised strong protest in some parts of Canada. In spite of this, however, in the elections of 1917, he was retained in power by a party called the Unionists, formed by a

union of Conservatives and Liberals. He was knighted in 1914.

SIR GILBERT PARKER, K. B.

In the literary world we find Canadians attracting considerable attention. One very successful English writer of today is a Canadian, Gilbert Parker. He was born at Camden, East Ontario, in 1862. After receiving his teacher's diploma, he taught school for a short time. In 1883, he entered Trinity University, Toronto, where he remained for two years. After giving up his college course, he taught for a few months in the Deaf and Dumb Institute at Belleville, went to Australia in 1886, and became associate editor of the Sydney Evening Herald. He turned playwright, dramatized Goethe's Faust, and wrote a play, The Vendetta. After four years of successful work he settled in England in order to devote his entire time to literature. He first gained recognition by his short stories. For his success in the literary world he was knighted in 1902. In 1900, he became a member of the British House of Commons. His chief novels are Northern Lights, The Weavers, A Ladder of Swords, The Right of Way, The Seats of the Mighty, and The Trail of the Sword.

CHARLES G. D. ROBERTS AND OTHER WRITERS

Another Canadian whose works are widely read is Charles G. D. Roberts. He was born near Fredericton, N. B., in 1860. He attended the common schools and then the University of New Brunswick, where he graduated in 1883. After teaching school for a year, he went to Toronto to become editor of a paper called The Week. In 1885, he was called to a professorship in English and Economics in King's College, N. S., and there remained until 1895, when he resigned to devote his entire time to literature. Two years later he went to New York, but did not remain. His important books are The Backwoodsman, The House in the Waste, The Heart that Knows, Red Fox, The Watchers of the Trails, Canadians of Old, and Around the Camp Fire. They are all tales of life in the woods, and of the wild animals who make their homes there.

Bliss Carman, who also graduated from New Brunswick University, is well known as a poet. His poems are not great, but they have much charm, and his ballads have a fine swing. Dr. William Drummond, an Irishman by birth, was a physician who wrote in their own dialect of the simple lives and thoughts of the French Canadian villagers among whom he lived. You will find some of his poems in the Book of Poetry. Charles Lampman was perhaps the best of the native Canadian poets, but he died at an early age, too soon to have shown what he could really do.

A writer whose works are widely read in Canada and the United States is Charles W. Gordon, better known as Ralph Connor, the name under which his novels appear. Charles Gordon was born at Indian Lands, Ontario, in 1860. He attended the common schools and then Toronto University, from which he graduated in 1883. For a time he served as a missionary in the Northwest Territories. In 1893, he was called to the West End Church, Winnipeg. The novels by which he became known are The Sky Pilot, Black Rock, The Man from Glengarry, The Doctor, The Settler, The Prospector and Glengarry Days. When the first Canadian contingent went overseas to join the armies of the mother country in the Great War, Ralph Connor went with them and served for a time as chaplain to a Winnipeg regiment.

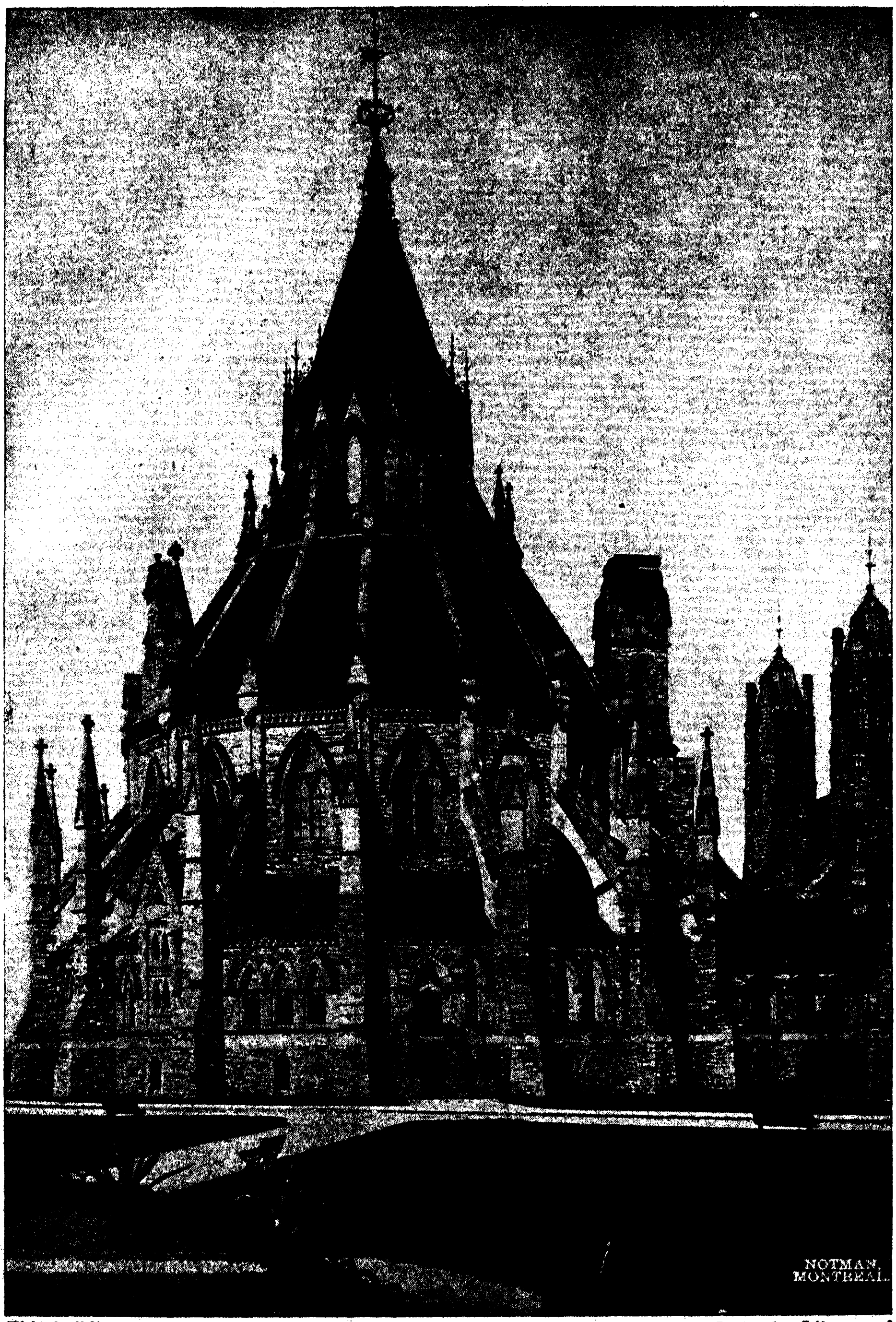
CANADIAN ARTISTS WHO ARE WELL KNOWN

The best known Canadian artists are Horatio Walker, a painter, who was born in the little town of Listowel in Ontario, and Louis Hébert, who was born in a Quebec village in 1850. Horatio Walker in his early youth studied miniature painting in Toronto. Although he never studied in France, he has been much influenced in his style by the French painters Millet and Troyon, to whom he has been compared. Nevertheless, his pictures show us the clear air of his own country, and his richly colored autumn woods are the woods of his native land. One of his pictures is shown on page 5298.

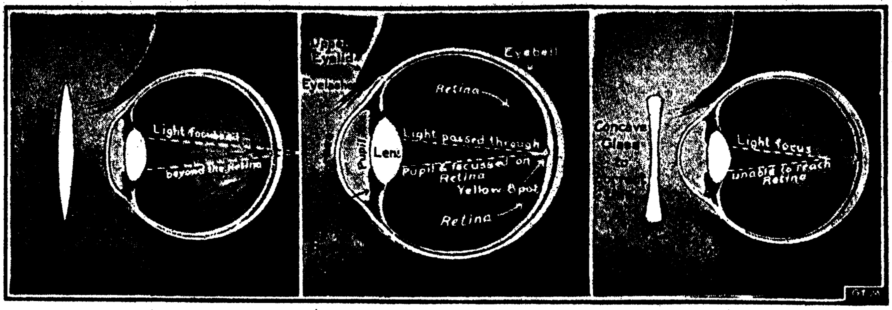
Louis Hébert studied first in Montreal, but soon went to Paris, where he continued to live. But his best work was done for Canada, and he is chiefly known by the bronze statues which he made for Ottawa, Montreal, Quebec, Halifax and Regina. Pictures of two of these statues may be found elsewhere in this book.

THE NEXT STORY OF CANADA IS ON PAGE 4621.

THE LIBRARY OF PARLIAMENT



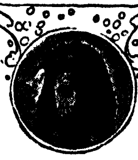
This building is decidedly unusual in appearance, but is pleasing nevertheless. It is the Library of Parliament at Ottawa, Canada, and may also be used as a public reference library It contains about 300,000 books, including everything that has been written about Canada. The building has sixteen sides, and flying buttresses surrounding the central tower give a pleasing impression. The interior is decorated with the arms of the Dominion and the separate provinces. As you have read elsewhere, the Parliament Buildings were destroyed by fire in February, 1916. The Library, however was not injured, and the valuable collection of books was saved. The Library overlooks the Ottawa River.



In the middle picture we see a section of a perfect eye, with the light focused correctly on the retina. The left-hand picture shows an eye in which the cornea is too flat, and the light being focused beyond the retina causes indistinct vision. The cornea of the eye on the right is too convex.

THE PARTS OF THE EYE

CONTINUED FROM 4264



WHEN we examine the eye, the first thing we notice is that the front of it is transparent. This round, transparent part in front is called the *cornea,* which really means the horny thing. If we look very carefully at it, we shall see that it bulges forward somewhat. The curve of it is not quite the same as the general curve of the eyeball. This shape of the cornea is very important because of its effect on the rays of light that enter it. It acts just like the curved surface of the eye-cell of a leaf.

The first and greatest business of the cornea is to be perfectly transparent. It contains, therefore, no blood-vessels, small or great; it would not do to have red or white blood-cells in the cornea interfering with the passage of light. But the cornea is alive and must be fed, and it is supplied by materials that pass to it through the walls of the tiny blood-vessels that we find all round its edge. The cornea is well supplied with nerves, nearly all of which run to its front surface, in order that it shall be very sensitive.

This is necessary so that the least speck of dust, or anything else that would injure it, shall be felt and wiped away by the eyelids and the tears. Only too often, however, a workman gets what he calls a "fire" in his eye, and then there is a great risk that, when the cornea recovers from the injury, the injured place will be opaque for the rest of his days. Also, when anything of this kind happens to the cornea, blood-vessels grow into it from the side. They must do so, for they must supply food and other materials to the injured part, if it is to recover; but these blood-vessels mean that the passage of light is interfered with.

Only a short time ago, the first successful attempt that has ever succeeded was made to remove a piece of cornea that had become opaque, and to graft there a piece of healthy transparent cornea. It is well for us to understand how important and wonderful this part of the eye is. All the light we see by must pass through it; yet it is a living thing, with all the needs and delicacy of a living thing—very different from a curved piece of glass. Lastly, it is very much exposed, though, as we know, the eyelid, eyelashes, eyebrow, and the bony wall around the eye do their best to protect it from injury.

All round its edge the cornea passes into the white, thick, strong coat of the eyeball; indeed, the cornea is really a special part of this strong outer coat of the eyeball that has been made transparent, and has been made to bulge forward a little in order to help in focusing the light.

The white outer coat of the eyeball is very strong, and will stand a good deal of pressure. If we feel one of our own eyes with the finger, we shall find that it is quite tight; and the existence of this pressure in the eyeball, which is supported by the outer coat, is of great importance for good seeing.

Now, when we look at anyone's eye, we see something through the transparent cornea. We see a round, colored ring with a black hole, small or large, in the middle of it. The colored part is called the *iris*, and it is a ring of muscle with a hole in the middle of it, which is the pupil. This looks black because it is really the hole leading into the dark chamber, or inside of the eye, which is like the inside of a camera. Now, if we could be shown an eye cut through sideways, we should see that there is quite a large space between the cornea and the front of the iris. This space is filled with a watery fluid, and the light has to pass through this fluid before it is able to reach the pupil.

THE PUPIL OF THE EYE THAT GROWS BRIGHT IN A DIM LIGHT

The business of the iris is to regulate the size of the pupil. The less the amount of light, the larger must the pupil be; and the more the light, the smaller the pupil. So when a person goes from darkness into light, or when the eyes are opened in a bright light, anyone may see that the pupil grows smaller. We can also notice that the pupil gets smaller if a person who has been looking at something far away suddenly looks at an object close to his eye. There is a special reason, rather difficult to explain, why it improves the clearness of vision to reduce the size of the pupil when looking at something near. The cause is to be found in the shape of what lies behind the pupil, as we shall soon see.

All the color of the eye is due to the iris. The color is not to be found at all in the muscle fibres that make the iris; they are just like other muscle fibres, and are the same in everybody. But both on the back and front of the iris there is a layer of cells, which may or may not contain a certain amount of pigment, or paint. It is this that varies in different people. It is interesting from the point of view of beauty, because its variations in different people provide many different types of beautiful eyes. But the color of the iris has quite lately become most interesting, because we have learned what are the rules as to the way in which eye-color descends from parent to child. This is one of the subjects which is being closely studied by scientific men all over the world, and we are no doubt going to learn a great deal from it.

THE PEOPLE WITH BLUE EYES AND THE PEOPLE WITH BROWN EYES

It seems that some eyes have brown pigment in the cells on the front of the iris, and others have not. This gives us at once two great types of eyes—those which have the brown pigment on the front being more or less brown, and those which have not being more or less blue. There is far more to say than this, of course, because, as everyone knows, there are many different blues and browns, and many eyes which could not be called either. But still we have already learned that a father and mother with genuine blue eyes never have brown-eyed children; on the other hand, if one parent has brown eyes and the other parent has blue eyes, most of the children, at any rate, will have brown eyes.

At present, in America, it seems quite plain that blue eyes are rapidly becoming rarer and brown eyes commoner. One of the deeply interesting questions is as to why this is so, and what the consequences will be. Careful study of the iris in thousands of people in all parts of the country, and especially the study of the eyes of children as compared with their parents, will teach us not only a great deal about heredity, as it is called, but will also help us to learn what is really happening, and how far it is true that the blue-eyed strain in the population is dying out and the brown-eyed people surviving.

THE PEOPLE WITH BLUE EYES WHO ARE DISAPPEARING FROM THE WORLD

It is very likely that though the blue-eyed seem less able to bear city life, and the conditions of existence nowadays, they probably may have many valuable qualities, and their slow disappearance threatens to be a great loss to the world, and ought to be thoroughly investigated, and some means found to check it.

Now, if we pass through the door in

the iris, we find a beautiful transparent thing called the *lens* of the eye. It is a genuine lens, just like the lens of an ordinary magnifying glass, and it is of the same shape, convex on both sides. It helps to bend the rays of light entering the eye, just as the cornea did, and it is perfectly transparent. Unlike any lens that any man ever made, this lens, while able to do all that artificial lenses do, can do far more; for it is elastic, and can change its shape as we please.

HOW THE LENS OF THE EYE IS KEPT INSIDE A LITTLE BAG

The lens lies inside a little bag, and that bag has little fibres attached to it all round, which can be pulled upon by tiny slips of muscle inside the eye. When the bag is pulled upon in this way all round, the lens inside it is made flatter. When the muscles stop acting and the pulling ceases, the lens is free to bulge out again if it is perfectly elastic.

It is by this power of the lens that we are enabled to see clearly both at short distances and at long distances. Now, as everyone knows, in the case of an ordinary camera, it is equally necessary to focus the light properly if the picture to be taken is to be sharply defined on the plate; or if we are using a magic lantern, we know that we must focus properly if the picture is to be sharply thrown on the screen. In these cases, and in all other cases where men use artificial lenses—as, for instance, in the microscope and the telescope—the same method of focusing is employed, and that is to alter the distance of the lens, or lenses—for there may be several—from the place where we want the image to fall.

HOW OUR EYES FOCUS BY CHANGING THE SHAPE OF THEIR LENSES

It is very interesting to discover that in the fishes this method, which men employ in all their instruments, is employed in the eye: the lens has its position shifted nearer to or farther from the *retina*, or screen, at the back of the eye. But in all the higher types of eye, such as our own, this method is not employed. There is no arrangement for shifting the lens backwards and forwards in order to suit the distance of the particular thing at which we are looking. Its distance from the retina is fixed. The method of the higher types of eye is not to alter its position, but to change its shape where it stands. That is why it has to be most perfectly elastic, so that after it has been flattened, by having the bag in which it lies pulled upon, it can spring back perfectly to its rounder shape.

This means that the shape of the eyeball, as a whole, is very important. An eyeball may be long from back to front, and then the lens is far from the retina, or it may be short from back to front, and then the lens is nearer the retina. If the lens be of the same shape in the two cases, one eye or both must certainly not be quite suited to its purpose. Thus, in consequence of the varying shapes of eyeballs, the variations in the curve of the cornea, and the variations in the shape of the lens itself, we find that there are a very large number of people whose eyes are not perfectly suited for all kinds of use.

SHORT-SIGHTEDNESS HAS NOTHING TO DO WITH THE HEALTH OF THE EYE

Nothing is more important than for us to understand, at the very first, that this is not at all a question of the health of the eye. An eye may be healthy or ill, like any other part of the body, but what we are now talking about is simply a question of the mere shape of the eye or certain parts of it. The bending of rays of light is called *refraction*, and so we usually speak of "errors of refraction" to describe those cases where an eye is short-sighted or long-sighted, or has some defect of that kind.

This has nothing to do with the health of the eye or of any other part of the body, except that, as we shall see, if something is not done, the rest of the body may be affected. We are to look upon the eye for the moment as a kind of optical instrument or machine, and simply to realize that the shape of this optical instrument will affect the rays of light that pass through it, just as in the case of any other optical instrument.

It is very commonly found that the cornea is not quite regularly curved; it bulges more or less in one direction, say, from side to side, than it does in another direction, say, from top to bottom. This means that, if we are looking at a cross, the one limb of it cannot be seen sharply if the other is. As a rule, this defect in the shape of the cornea is so slight that

it is not worth bothering about; but often it is worth while to wear glasses which are more curved in one direction than in another—more curved in the direction in which the cornea is less curved, and less curved where the cornea is more curved—so that the little defect is corrected. This particular error of refraction is not nearly so important as those we must now study.

WHY IT IS THAT SOME PEOPLE BECOME SHORT-SIGHTED

Short-sightedness is what happens when the eyeball is rather too long from back to front. This error of refraction means that the light is focused before it reaches the retina, and when it does reach the retina the picture it makes is rather blurred. Sometimes, also, short-sightedness may be due to the cornea being too much curved, so that it acts as too strong a lens, and the rays of light are focused too soon.

Short-sightedness is a very common defect, and is very inconvenient. We can see anything near quite well; the things farther off are blurred. The reason why we see things clearly when they are quite near, and why we therefore always hold a book close to our eyes, is that, when a thing is held close, the eye catches the light rays from it as they are spreading out.

If they are spreading out when they reach the eye, they are not so likely to be focused too soon; but if the thing is farther away, then the rays coming to it from the eye are not spreading out, or divergent, as we say, but are parallel, and will be too easily focused for the convenience of an eye that is too long from back to front.

THE NUISANCE OF BEING SHORT-SIGHTED WHEN PLAYING GAMES

The short-sighted person is at a disadvantage in recognizing people, and also in playing games. It is a nuisance to have to wear glasses to see clearly at any distance; but, on the other hand, he suffers no injury if he wears no glasses, and his eyes are very well suited for work at short distances, such as reading and writing, looking after machinery, sewing, and, indeed, nine-tenths of all the work that is done by civilized people to-day. People who start short-sighted when they are quite young, or who even are long-sighted at first—as most young children are—often become gradually more and more short-sighted until the age of, perhaps, thirty. Most of the people who study this subject are very sure what the cause of this is, only, unfortunately, they do not agree with each other.

Some of them who have not really gone into it properly think that the short-sightedness is a sort of disease of the eye, and is due to over-use of it, bad conditions during childhood, and so forth. Others think that it is a natural change which is bound to happen in any case; and still other people suppose that this increase in short-sightedness is due to the constant use of the eye at short distances.

The truth lies somewhere between the last two opinions; each of them is probably true in part. The eye, like other parts of the body, does undergo natural changes during life, and as it gradually becomes more long-sighted after a certain age, quite apart from anything that is done to it, there is no reason why it should not become more short-sighted during the earlier years.

HOW SHORT SIGHT IS CAUSED BY USING THE EYE FOR SHORT DISTANCES

On the other hand, we can prove that, when the eye is used for short distances, certain muscles inside it are used in such a way as to tend to make the eyeball longer from back to front, and therefore more short-sighted.

The reason for going carefully into this is that very few people understand the facts, and many doctors even have not properly inquired into them. Young people between the ages of twenty and twenty-five find, very often, that year by year they get rather more short-sighted; perhaps they require to use glasses for games where formerly they did not need them, and the glasses have to be made stronger and stronger; or parents find their children beginning to require glasses for short sight, and every couple of years or so the glasses have to be made stronger.

People are alarmed if they think that all this means a kind of disease of the eye, or if they begin to ask themselves where this is going to stop. That is why everyone should understand that short sight is not a disease at all; that the changes which go on are natural; that they only go on to a certain point.

More than this, it is certain that we may look upon short-sightedness in our time as a kind of adaptation to our needs—that is to say, in the case of the great majority of people who have to use their eyes at short distances. For such distances the short-sighted eye is just the best that one can have; it lasts splendidly, and does not tire.

SHORT-SIGHTED PEOPLE MAY BECOME LONG-SIGHTED AS THEY GROW OLD

After a certain age, perhaps about forty-five, or later, the eyes, after having remained just as they were for many years, begin slowly to become long-sighted, or less short-sighted, as the case may be. But before we look at this we must return to the case of the child.

Practically all very young children are long-sighted. A certain number of them remain long-sighted as the years go on, and are still long-sighted when they begin to learn to read and write. There is no more disease or ill-health here than there is in the other case, but simply the eyeball is too short from back to front, the cornea is too flat, and so the rays of light are not focused sharply in time, and reach the retina sooner than they should. The retina is too near the lens.

Now, in days that are gone this was no serious matter, because people lived far more natural lives than they do now; perhaps we should say far more animal lives than they do now; but that is a difficult question. Anyhow, they lived much more in the open air. Instead of constantly reading books at a few inches distance, they had to read the book of the distant clouds and mountains; they had to see animals or enemies at great distances, and the use of their eyes for short distances was only occasional.

THE DIFFERENT USES FOR WHICH NATURE HAS FITTED DIFFERENT EYES

When the eye is to be used at long distances, evidently the long-sighted eye has little to complain of. It is as well off as the short-sighted eye is in the kind of life that most of us are living nowadays.

The time may yet come when, before we decide what to make of our children, we may care to ask ourselves the question: What has Nature made them for? Perhaps, for instance, other things being equal, we should think twice before we sent the long-sighted boy to a desk rather than to sea or to Europe. Meanwhile, however, our general idea is that all children are just the same, and require just the same treatment, and the long-sighted child is treated just like the other. But, whatever we do in this way, it is certainly our business to see that we do not hurt him in the process. We do hurt him, and it is easy to show why.

The long-sighted eye, we have said, is too short from back to front. The rays of light are not focused in time. Now, if such an eye is to be used at short distances, it will be very much strained, because the muscles inside the eye will constantly be trying to change the shape of the lens in order to make the eye focus better; in fact, the long-sighted eye requires to use the muscles inside it in all circumstances. This means that it is liable to get tired, and every long-sighted person knows what it is to get headache and eye-strain from the use of the eyes under conditions which would not be at all inconvenient or disturbing to a short-sighted person.

THE FOOLISHNESS OF MAKING CHILDREN USE THEIR EYES IN A WRONG WAY

In our ignorance and carelessness regarding children, and in the very foolish way that we pretend to educate them, we at present inflict very grave cruelty, and perhaps often injury that is never recovered from, upon large numbers of children everywhere by compelling them to use long-sighted eyes for purposes to which they are not suited.

All over the country, children are straining their eyes at reading and writing, gaining no good, but only harm, from what we do for them, and all they need is a pair of spectacles with rounded convex lenses that will help to focus the rays of light quickly, so that they are brought sharply together by the time they reach the retina at the back of these short eyes. It is the short eye, we must notice, that is long-sighted, and it is the long eye that is short-sighted.

We have just begun to discover how important this subject is, and, now that it is slowly occurring to us that before we begin to educate a child we must make it fit to be educated, we may

hope that, within a very few years from now, no long-sighted child will be allowed to be injured for the lack of spectacles costing a few dollars. The relief obtained when proper glasses are employed is quite astonishing.

As we shall readily understand, it is concave lenses that are used in spectacles for the short-sighted eye, and convex lenses that are used in spectacles for the long-sighted eye. We may think this out for ourselves.

As people become elderly the eye becomes more long-sighted; this change oftenest occurs at some time after forty-five. If the person was short-sighted, he now becomes less so. Indeed, if we take the whole course of life, there can be no doubt that, under ordinary modern conditions the short-sighted person is much better off than the long-sighted person, although at first it may not appear to be the case.

THE LENS OF THE EYE THAT CEASES TO BE ELASTIC AND CAUSES LONG SIGHT

The long-sightedness of elderly people is due to changes that occur mainly in the lens of the eye. The all-important elasticity of the lens becomes impaired, and it does not bulge, when the pressure of its coat is removed, as readily as it used to do; indeed, it becomes decidedly flatter. In extreme old age the lens loses its elasticity to such an extent that its shape cannot be changed at all.

The commonest sign that the eyes are beginning to show this change is that the person finds it more difficult to read in a dim light. It is very much better to be sensible about this and wear glasses than to try to fight against it. This does no good, and, on the other hand, it may do just the same kind of harm as is done to the long-sighted child that is "educated," as we call it, without having glasses provided for him. The same is true in this case, as we have already seen, that people suppose the need for glasses to be a sign of weakness or disease, and so they think they ought to fight against it.

Now, it is good to fight against weaknesses, and there is not much hope for people who do not; but, if we understand the facts, the weakness is in being too proud to wear glasses or too careless. Of all the many evils from which mankind suffers, there are very few more unnecessary, more easily and cheaply relieved, than those due to errors of refraction in the eye, which we have just been briefly studying.

WHY MANY GREAT MEN OF THE PAST BECAME BLIND

In old age, or sometimes before it, the lens of the eye may become opaque. Much the commonest form of this misfortune is found in old age, but there is also a very definite form which may occur in quite young people, and which is known to appear in a regular way in parents and children. *Cataract* is the name applied to opaqueness of the lens. Its consequence is blindness. The time was, and that quite recently, when there was no remedy for this terrible affliction.

We know that many of the very great men of the past became blind in their old age, and in many cases it was cataract that was the cause. Nowadays science triumphs over this calamity. Thanks to those who have studied the structure of the eye, and thanks to Pasteur and Lord Lister, who have taught us how to keep microbes away from wounds, so that they shall heal easily and painlessly and certainly, it is now possible simply to make a little cut in the eye, then a little cut in the coat of the lens, and then, by a little squeeze, to push the lens out through the cut which was made—and there it lies in the surgeon's hand, looking almost like a little lens of ground glass.

This would probably have to be done to both eyes, though it makes all the difference in the world if it were done to only one eye when both were affected. It is easily done, without pain. The obstacle to the light is now gone, and the light can pour through to the retina; but the rays are not focused, and things cannot be properly seen.

HOW SCIENCE IS ABLE TO GIVE SIGHT TO THE BLIND

The remedy is to supply the person with spectacles, with strong convex lenses that take the place of the lenses he has lost. Few operations, so simple and so easy and so certain, do so much for old people, and it would be worth while to study the eye, if only to learn how it is possible, by the application of our knowledge, to give sight to the blind in this way, as is done all over the civilized world many times daily.

THE NEXT PART OF THIS IS ON PAGE 4425.

A FAMOUS AMERICAN POEM

THIS poem made the name of the American poet, Edgar Allen Poe, famous throughout his own land and widely known throughout Europe and the English-speaking world. When we read "The Raven," we seem to feel the anguish of a strong and loving nature to whom a dear one has but lately been lost. But this is entirely a work of imagination, not of personal feeling. The poem was first suggested to its author by his reading some verses entitled "Isadore," in which the refrain was, "Thou art lost to me for ever, Isadore." "Isadore" was written by an American author, long since forgotten, to express the emotion he imagined one would feel at the loss of a loved one, not because he was really in sorrow. Thus Edgar Allen Poe's world-famous poem was suggested to him by a poem which was also purely an effort of imagination. The raven he introduced from having been impressed by Grip in "Barnaby Rudge," and sought thus to invest the strange bird with more dramatic and mysterious interest.

THE RAVEN

CONTINUED FROM 4190

ONCE upon a midnight dreary, while I pondered, weak and weary,
Over many a quaint and curious volume of forgotten lore—
While I nodded, nearly napping, suddenly there came a tapping,
As of someone gently rapping—rapping at my chamber door.
" 'Tis some visitor," I muttered, " tapping at my chamber door—
Only this and nothing more."

Ah, distinctly I remember, it was in the bleak December,
And each separate dying ember wrought its ghost upon the floor.
Eagerly I wished the morrow—vainly I had sought to borrow
From my books surcease of sorrow—sorrow for the lost Lenore—
For the rare and radiant maiden whom the angels name Lenore—
Nameless here for evermore.

And the silken, sad, uncertain rustling of each purple curtain
Thrilled me—filled me with fantastic terrors never felt before;
So that now, to still the beating of my heart, I stood repeating,
" 'Tis some visitor entreating entrance at my chamber door—
Some late visitor entreating entrance at my chamber door—
This it is and nothing more."

Presently my soul grew stronger; hesitating then no longer,
" Sir," said I, " or Madam, truly your forgiveness I implore;
But the fact is I was napping, and so gently you came rapping,
And so faintly you came tapping—tapping at my chamber door,
That I scarce was sure I heard you "—here I opened wide the door—
Darkness there and nothing more.

Deep into that darkness peering, long I stood there, wondering, fearing,
Doubting, dreaming dreams no mortal ever dared to dream before;
But the silence was unbroken, and the stillness gave no token,
And the only word there spoken was the whispered word, " Lenore!"
This I whispered, and an echo murmured back the word, " Lenore!"—
Merely this and nothing more.

Back into the chamber turning, all my soul within me burning,
Soon again I heard a tapping, somewhat louder than before.
" Surely," said I, " surely that is something at my window lattice;
Let me see, then, what thereat is, and this mystery explore—
Let my heart be still a moment, and this mystery explore—
'Tis the wind and nothing more."

Open here I flung the shutter, when, with many a flirt and flutter,
In there stepped a stately Raven of the saintly days of yore.
Not the least obeisance made he; not an instant stopped or stayed he;
But, with mien of lord or lady, perched above my chamber door—
Perched upon a bust of Pallas, just above my chamber door—
Perched and sat, and nothing more.

Then this ebony bird beguiling my sad fancy into smiling,
By the grave and stern decorum of the countenance it wore,
" Though thy crest be shorn and shaven, thou," I said, " art sure no craven,
Ghastly, grim, and ancient Raven, wandering from the Nightly shore—
Tell me what thy lordly name is on the Night's Plutonian shore!"
Quoth the Raven, " Nevermore."

Much I marvelled this ungainly fowl to hear discourse so plainly,
Though its answer little meaning—little relevancy bore;
For we cannot help agreeing that no living human being
Ever yet was blessed with seeing bird above his chamber door—
Bird or beast upon the sculptured bust above his chamber door,
With such name as "Nevermore."

But the Raven, sitting lonely on the placid bust, spoke only
That one word, as if his soul in that one word he did outpour.
Nothing further then he uttered; not a feather then he fluttered —
Till I scarcely more than muttered, "Other friends have flown before—
On the morrow *he* will leave me, as my Hopes have flown before."
Then the bird said, "Nevermore."

Startled at the stillness broken by reply so aptly spoken,
"Doubtless," said I, "what it utters is its only stock and store,
Taught from some unhappy master, whom unmerciful Disaster
Followed fast and followed faster till his songs one burden bore—
Till the dirges of his Hope that melancholy burden bore
Of 'Never—nevermore.'"

But the Raven still beguiling all my sad soul into smiling,
Straight I wheeled a cushioned seat in front of bird and bust and door;
Then, upon the velvet sinking, I betook myself to linking
Fancy unto fancy, thinking what this ominous bird of yore,
What this grim, ungainly, ghastly, gaunt, and ominous bird of yore
Meant in croaking "Nevermore."

This I sat engaged in guessing, but no syllable expressing
To the fowl whose fiery eyes now burned into my bosom's core;
This and more I sat divining, with my head at ease reclining
On the cushion's velvet lining that the lamp-light gloated o'er,
But whose velvet violet lining, with the lamp-light gloating o'er,
She shall press, ah, nevermore!

Then methought the air grew denser, perfumed from an unseen censer
Swung by Seraphim whose footfalls tinkled on the tufted floor.
"Wretch," I cried, "thy God hath lent thee—by these angels He hath sent thee
Respite—respite and nepenthe from thy memories of Lenore!
Quaff, oh quaff this kind nepenthe, and forget this lost Lenore!"
Quoth the Raven, "Nevermore."

"Prophet!" said I, "thing of evil!—prophet still, if bird or devil!—
Whether Tempter sent, or whether tempest tossed thee here ashore,
Desolate, yet all undaunted, on this desert land enchanted—
On this home by Horror haunted—tell me truly, I implore—
Is there—*is* there balm in Gilead?—tell me—tell me, I implore!"
Quoth the Raven, "Nevermore."

"Prophet!" said I, "thing of evil!—prophet still, if bird or devil,
By that Heaven that bends above us—by that God we both adore—
Tell this soul with sorrow laden if, within the distant Aidenn,
It shall clasp a sainted maiden whom the angels name Lenore—
Clasp a rare and radiant maiden whom the angels name Lenore."
Quoth the Raven, "Nevermore."

"Be that word our sign of parting, bird or fiend!" I shrieked, upstarting—
"Get thee back into the tempest and the Night's Plutonian shore!
Leave no black plume as a token of that lie thy soul hath spoken!
Leave my loneliness unbroken!—quit the bust above my door!
Take thy beak from out my heart, and take thy form from off my door!"
Quoth the Raven, "Nevermore."

And the Raven, never flitting, still is sitting—still is sitting
On the pallid bust of Pallas, just above my chamber door;
And his eyes have all the seeming of a Demon's that is dreaming,
And the lamp-light o'er him streaming throws his shadow on the floor;
And my soul from out that shadow that lies floating on the floor
Shall be lifted—nevermore!

THE HOUSEKEEPER

This quaintly humorous description of the snail was written by Charles Lamb, and it is in simple verses such as these that we can detect the kindly, gentle feeling of the poet, and his sympathy with the lowliest creatures of God's creation.

THE frugal snail, with forecast of repose,
Carries his house with him where'er he goes;
Peeps out—and if there comes a shower of rain,
Retreats to his small domicile again.
Touch but a tip of him, a horn—'tis well—
He curls up in his sanctuary shell.
He's his own landlord, his own tenant; stay
Long as he will, he dreads no quarter day.
Himself he boards and lodges; both invites
And feasts himself; sleeps with himself o' nights
He spares the upholsterer trouble to procure
Chattels; himself is his own furniture,
And his sole riches. Wheresoe'er he roam,
Knock when you will—he's sure to be at home.

AHAB MOHAMMED

There are many beautiful stories in the history of the Arabian rulers, and most poets have at some time or other turned to the rich legends of the East for inspiring themes. Few of those stories are more attractive than that of "Ahab Mohammed," which an American poet, named James Matthew Legaré, has set in this becoming dress of verse.

A PEASANT stood before a king, and said:
"My children starve, I come to thee for bread."
On cushions soft and silken, sat enthroned
The king, and looked on him that prayed and moaned,
Who cried again: "For bread I come to thee!"
For grief, like wine, the tongue will render free.
Then said the prince with simple truth: "Behold
I sit on cushions silken-soft, of gold,
And wrought with skill the vessels which they bring
To fitly grace the banquet of a king.
But at my gate the Mede triumphant beats,
And die for food my people in the streets.
Yet no good father hears his child complain
And gives him stones for bread, for alms disdain.
Come, thou and I will sup together—come!"
The wondering courtiers saw—saw and were dumb:
Then followed with their eyes where Ahab led
With grace the humble guest, amazed, to share his bread.
Him half-abashed the royal host withdrew
Into a room, the curtained doorway through.
Silent behind the folds of purple closed,
In marble life the statues stood disposed;
From the high ceiling, perfume breathing, hung
Lamps rich, pomegranate-shaped, and golden-swung.
Gorgeous the board with massive metal shone,
Gorgeous with gems arose in front a throne:
These through the Orient lattice saw the sun.
If gold there was, of meat and bread was none,
Save one small loaf; this stretched his hand and took
Ahab Mohammed, prayed to God, and broke:
One half his yearning nature bid him crave,
The other gladly to his guest he gave.
"I have no more to give," he cheerily said:
"With thee I share my only loaf of bread."
Humbly the stranger took the offered crumb,
Yet ate not of it, standing meek and dumb;
Then lifts his eyes—the wondering Ahab saw
His rags fall from him as the snow in thaw.
Resplendent, blue, those orbs upon him turned;
All Ahab's soul within him throbbed and burned.
"Ahab Mohammed," spoke the vision then,
"From this thou shalt be blessed among men.
Go forth—thy gates the Mede bewildered flees,
And Allah thanks thy people on their knees.
He who gives somewhat does a worthy deed,
Of him the Recording Angel shall take heed.
But he that halves all that his house doth hold,
His deeds are more to God, yea, more than finest gold!"

SPEAK GENTLY

This is a very old lesson in conduct, which has seen service in many children's books for fifty years or more. We can scarcely dignify it with the name of poetry, but as moral teaching in rhyme it is still worthy of repetition. Usually printed without the name of its author, it was most probably written by David Bates, an American poet, who lived and worked in Philadelphia about the middle of the last century.

SPEAK gently!—It is better far
To rule by love than fear—
Speak gently—let not harsh words mar
The good we might do here!

Speak gently!—love doth whisper low
The vows that true hearts bind;
And gently Friendship's accents flow—
Affection's voice is kind.

Speak gently to the little child!
Its love be sure to gain;
Teach it in accents soft and mild,
It may not long remain.

Speak gently to the young, for they
Will have enough to bear;
Pass through this life as best they may,
'Tis full of anxious care!

Speak gently to the aged one,
Grieve not the careworn heart;
The sands of life are nearly run,
Let such in peace depart.

Speak gently, kindly to the poor—
Let no harsh tone be heard;
They have enough they must endure,
Without an unkind word!

Speak gently to the erring—know
They may have toiled in vain;
Perchance unkindness made them so;
Oh! win them back again!

A LIFE LESSON *

James Whitcomb Riley was one of the most charming of all the American poets, and none, except the late Eugene Field, many of whose pieces have appeared in our book, has equaled him in his poems of child-life. The following, however, is not exactly a children's poem, but is a tender little study of one who grows up to meet unhappiness, and a reminder that the joys this world takes away are small compared with those the truly religious life has to offer us.

THERE, little girl, don't cry!
They have broken your doll, I know;
And your tea-set blue,
And your playhouse, too,
Are things of the long ago.
But childish troubles will soon pass by.
There, little girl, don't cry!

There, little girl, don't cry!
They have broken your slate, I know;
And the glad, wild ways
Of your schoolgirl days
Are things of the long ago;
But life and love will soon come by—
There, little girl, don't cry!

There, little girl, don't cry!
They have broken your heart, I know;
And the rainbow gleams
Of your youthful dreams
Are things of the long ago;
But heaven holds all for which you sigh—
There, little girl, don't cry!

* From "Child Rhymes," copyright, 1899. By special permission of the publishers, The Bobbs-Merrill Co.

THE WORK OF THE POETS

Arthur O'Shaughnessy, the author of these dreamy verses, was born in 1844. He became an assistant, first in the library, and afterwards in the natural history department of the British Museum, and died in 1881 at the early age of thirty-seven. From this poem we may learn that he held the very highest opinions of the poet's mission and influence.

WE are the music-makers,
And we are the dreamers of dreams,
Wandering by lone sea-breakers,
And sitting by desolate streams;
World-losers and world-forsakers,
On whom the pale moon gleams:
Yet we are the movers and shakers
Of the world for ever, it seems.

With wonderful deathless ditties
We build up the world's great cities,
And out of a fabulous story
We fashion an empire's glory:
One man with a dream, at pleasure,
Shall go forth and conquer a crown;
And three with a new song's measure
Can trample an empire down.

We, in the ages lying
In the buried past of the earth,
Built Nineveh with our sighing,
And Babel itself with our mirth;
And overthrew them with prophesying
To the old of the new world's worth;
For each age is a dream that is dying,
Or one that is coming to birth.

THE GLADNESS OF NATURE*

American poets have largely found an abiding pleasure in singing the praises of wood and river, and William Cullen Bryant yielded to none in his willing homage to Nature. His devotion is proved by the many touches in this poem that show how closely he observed all things, from a dancing leaf to a flying cloud, from the twittering wren to the jovial, beaming sun. The hang-bird, or hang-nest, as it is often called, builds a nest like a huge pear turned upside down, or sometimes like an open cup, hanging on the branch of a tree.

IS this a time to be cloudy and sad,
When our mother Nature laughs around;
When even the deep blue heavens look glad,
And gladness breathes from the blossoming ground?

There are notes of joy from the hang-bird and wren,
And the gossip of swallows through all the sky;
The ground-squirrel gaily chirps by his den,
And the wilding bee hums merrily by.

The clouds are at play in the azure space,
And their shadows at play on the bright-green vale;
And here they stretch to the frolic chase,
And there they roll on the easy gale.

There's a dance of leaves in that aspen bower,
There's a titter of winds in that beechen tree,
There's a smile on the fruit, and a smile on the flower,
And a laugh from the brook that runs to the sea.

And look at the broad-faced sun, how he smiles
On the dewy earth that smiles in his ray,
On the leaping waters and gay young isles—
Ay, look, and he'll smile thy gloom away.

A POET'S LAST THOUGHTS

Like other hapless sons of the muses, John Clare, who was born in the county of Northampton in 1793, went through many hardships. During a great part of his life his lot was that of a farm laborer, and long before he died, in 1864, his mind was unhinged. His fate will account to some extent, if not altogether, for the sadness of the following lines by him.

I AM! yet what I am who cares, or knows?
My friends forsake me like a memory lost.
I am the self-consumer of my woes;
They rise and vanish, an oblivious host,
Shadows of life, whose very soul is lost.
And yet I am—I live—though I am toss'd.

Into the nothingness of scorn and noise,
Into the living sea of waking dream,
Where there is neither sense of life, nor joys,
But the huge shipwreck of my own esteem
And all that's dear. Even those I loved the best
Are strange—nay, they are stranger than the rest.

I long for scenes where man has never trod—
For scenes where women never smiled or wept—
There to abide with my Creator, God,
And sleep as I in childhood sweetly slept.
Full of high thoughts, unborn. So let me lie—
The grass below; above, the vaulted sky.

THE SANDPIPER

Here is another instance of Nature worship on the part of an American poet. Celia Thaxter, who was born in 1836 and died in 1894, had a narrower range than her more distinguished compatriot Bryant, but yet warbled sweetly her native woodnotes wild. She was especially fond of the sea, perhaps because her father was for many years keeper of a lighthouse. The sandpiper is a lively little shore-bird that flits about from point to point in search of shell-fish.

ACROSS the narrow beach we flit,
One little sandpiper and I;
And fast I gather, bit by bit,
The scattered driftwood, bleached and dry.
The wild waves reach their hands for it,
The wild wind raves, the tide runs high,
As up and down the beach we flit—
One little sandpiper and I.

Above our heads the sullen clouds
Scud black and swift across the sky;
Like silent ghosts in misty shrouds
Stand out the white lighthouses high.
Almost as far as eye can reach
I see the close-reefed vessels fly,
As fast we flit along the beach—
One little sandpiper and I.

I watch him as he skims along,
Uttering his sweet and mournful cry.
He starts not at my fitful song,
Or flash of fluttering drapery.
He has no thought of any wrong;
He scans me with a fearless eye.
Stanch friends are we, well tried and strong,
The little sandpiper and I.

Comrade, where wilt thou be to-night
When the loosed storm breaks furiously?
My driftwood fire will burn so bright!
To what warm shelter canst thou fly?
I do not fear for thee, though wroth
The tempest rushes through the sky:
For are we not God's children both,
Thou, little sandpiper, and I?

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